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THE RELATION OF TRAUMA TO CANCER FORMATION.*

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THE relation of traumatism to cancer has of late been made a question of much medicolegal importance. It has been alleged, with special reference to the female breast, that cancer may result from an injury inflicted many years before. This assumption has been based upon the supposed opinions of various writers of more or less distinction; and in certain cases has been the essential ground upon which large sums of money have been awarded for personal injury. In perhaps the most recent of these cases, one in which a scirrhous nodule was first noted twenty-one months after injury, there had been only a slight contusion; and pain was the only intervening symptom. The contusion was so slight that it received no attention from the physicians who then and afterwards attended the patient for a fractured rib which was upon the opposite side; and the pain in the breast was associated with similar pains in various other parts of the body which were recognized as neurasthenic. The judicial

* In this article cancer and carcinoma will be used as convertible terms in order to conform to the usage of many of the writers cited.

result in this case in the lack of other evidence seems to have merely reflected the belief which is general without, and to a considerable extent, is prevalent within the profession, that trauma whatever its nature as an effective cause of cancer is a fact sufficiently established by the expressed opinions of writers who are held to be, as it is termed "authorities."

A somewhat extended reference to the literature of this subject is necessary in order to discover how well or how ill founded is this estimate of the expressed judgment of the profession, past and present. Such an examination has been made of all the available contributions to the study of cancer, including transactions of societies, monographs, and systematic works, upwards of 300 in number. The authors are mainly American, English, French, and German, writing from the beginning of the Christian Era to the present time. It has of course been impossible to make this examination exhaustive. From 1892 to 1897 alone there were published upwards of 3000 books and articles upon this subject of which naturally nearly 2000 were of German authorship (*Br. M. J.*, v, ii, p. 448). The very considerable number of authors available, however, includes the most eminent surgeons and pathologists who have written of cancer, and is fully representative.

Sarcoma as structurally an essentially different disease from cancer has been excluded from consideration.

Theories, opinions, and beliefs in regard to cancer formation have greatly varied at different epochs, and their acceptance has often incidentally excluded the influence of traumatism. During the lengthened period extending from the time of Hippocrates to the end of the seventeenth century the humoral pathology without essential change held undisputed sway. Galen accepted the doctrines of Hippocrates as did his contemporaries, Rhases, Avicenna, and Hali-Abbas, and as did their successors the dicta of all these earlier writers. All tumors in their view were dependent upon change in composition or distribution of one or more fluids of the body. The fluid might be real, as the bile, blood, or chyle, or imaginary as "fleame," or as "melancholy," which was most fre-

quently invoked. "Fleame as Avicenna declareth in his Chaptyr of Humours, is nothing else but bloud unperfectly decocted." Melancholy "was a colde drie humor engendered from the chyle," and might be naturall or unnaturall, and might be simple or mixed with other evill humors." (Guy de Chauliac—Vigo). When naturall, according to Guy, it was the "dregs" or mere of good bloud, and unnaturall when it was in excess; but Peter Lowe considered unnatural melancholia to be the "most grosse partes of the chyle."

Cancer or kanker was an aposteme (tumor against nature —"contre nature" (Galen, Hali-Abbas). It might result from the degeneration of a scherre or sephiros, as described by Rastis and Avicenna, or it might be of primary formation. It was attributed to very much the same essential cause at different periods. Galen claimed it to be formed of overheated black bile; Rastis and Avicenna, in the tenth and eleventh centuries, that it was a scirrhus "engendered of grosse fleame or indurated melancholia," to which had succeeded "pyckynge sharpe payne, inflammation and pulsation, the accidentas of a hot apostema"; Guy de Chauliac in the fourteenth century, "that it was made of unnatural melancholy"; Peter of Argelata in the fifteenth century that it was "adust melancolie," the grosser part of adust colère; Vigo in the sixteenth century that it was an "aposteme of adust or burnt melancholie through the adustion or burning of cholere with the veynes round about full of melancholike bloud"; Paré, also of the sixteenth century, that it was "bred in the corruption and adustion of the melancholik humour." In the seventeenth century Peter Lowe (1612) held the cause to be "a drie melancholick humour however not only in the part as in schirr, but also in the vaines about it, the which in tyme became sharpe and maligne and so became ulcerate"; Bannister (1633) that "the antecedent cause was a melancholike humour abounding in the body and the conjoynde cause was the melancholike juice contained in the part affected"; Tagaultius (1645), that "it was in a melancholic humour without ebullition"; and Joseph Cook (1675), "that it was made from adust blood."

It is evident from this sketch of a primitive pathology that it could have had no possible relation to traumatism; nor is any allusion made to previous injury in connection with the history of cancer by any writer till near the close of the seventeenth century, and then only in a single instance, though age, diet, regional preferences, and other conditions still recognized as favoring the development of cancer are fully noted. Clinical investigation and analysis were generally painstaking and intelligent and it would seem that even a coincidence of cancer and traumatism could hardly have escaped recognition.

Richard Wiseman who wrote in 1676 enumerates a bruise, ill handling, and an error in diet as acquired faults which are remote causes of cancer. He makes no further reference to bruises, however, except that in a number of cases which he reports he mentions two in either of which the patient "thought it (the cancer) came from some accidental bruise"; and this, the patient's impression of what might have been seems to have been his only reason for including bruises in his etiology. He makes much of the "Error in diet, viz., a great acrimony in the meats and drinks with a fault in the first concoction which not being afterwards corrected in the guts suffered this acrimonious matter to ascend into the Bloud . . . or if by any defect in those (menstrua, urine, etc.), the Humours divert to any peculiar part then the foundation of this disease is laid, whether in the Breasts . . . ."

He remains a humoral pathologist though not quite in accord with the prevailing opinion of his predecessors. "The cause of cancer is usually said to be the adustion of the humours which upon an over concoction or rather broiling grow retorrid and sharp. . . . but I rather think the matter of the humour to be in fault . . . I rather impute the corrosive venom that attends this tumour to the material of which it is made than to any extraordinary heat which by some error in concoction becomes sharp and corrosive—(and) is apt to convert whatever comes to it of Bloud into the same acrimony with itself."

Theories of cancer formation in the eighteenth and early

nineteenth centuries were many and diverse; but the old humoral pathology was not at once discarded. Heister, Mihles, De La Motte, all maintained belief in an acrimony of the humors; and Le Dran as late as 1766 makes this acrimony, due to vascular obstruction, the proximate cause; and while the obstruction might result from many things, the genesis of the acrimony he pronounces inexplicable. Many other theories were suggested. Justasmond (1789), for example, and others believed for various reasons stated that cancer was produced by full grown insects, taken up from the atmosphere through the lymphatics. But the theory of inflammation as the determining cause of cancer, which must have had some vogue early in the eighteenth century since one Theodorus Tissot in his inaugural thesis ("De Schirro," 1718) gave it prominence, became to a great extent the one accepted; and traumatism as its provocative was in turn generally held responsible for the inflammation,—so much so that Joseph Adams (1795) felt called upon to protest—which he did in these words:

"It is assumed perhaps too generally that blows occasion cancer: But the insufficiency of many of these injuries, the immense distance of the period, and the very frequent occurrence of the disease without any such cause, are sufficient to render it equivocal. . . . At the same time this ill founded notion has taught almost every sufferer to recollect some little incident in her existence which might have produced the disease."

In the first half of the nineteenth century inflammation, either idiopathic or resulting from some form of injury, was the cause assigned for cancer development by rather more than 50 per cent. of the authors consulted. The prevalence for a time of Broussais' doctrine that all tumors are the result of chronic inflammation consequent upon organic irritation was largely responsible for this large percentage. Theories of lymph and blastemic formation, and various more or less fanciful causes which were also asserted, such as contagion, catching cold, mental exhaustion, modified secretion and

morbid material in the tissues, could have had no relation to sudden injury. Hughes Bennett (1849) concluded that cancerous as well as other forms of exudation originated in nervous and vascular derangements, but did not attribute the preceding capillary congestion to local causes, traumatic or otherwise. He believed that previous constitutional changes should receive greater attention than had been given them.

The latter half of the nineteenth century was prolific in contributions to the study of cancer; and etiological theories and explanations became more rational as means of pathological observations were extended. As this period so closely impinges upon the present time that its influence is still patent, the relation of trauma to the development of cancer as then estimated should be given consideration in determining the present sentiment of the profession; and the opinions of authors of that epoch should be quoted statically and in some detail.

During the first and second decades of this period attention was still largely directed to extrinsic causes, but later was more concentrated upon the single question of local or constitutional origin. Writers generally, however, continued to hold and express diverse opinions as to the influence of traumatism in the production of the disease. A classification of authors may be based upon this diversity of opinion:

Number of authors.	Causes assigned.
15	Single and transient injuries.
16	Trauma limited to persistent irritation.
8	Trauma limited to chronic inflammation.
17	All forms of trauma excluded.
26	Trauma unmentioned.
26	Exclusive intrinsic causes.
9	No theories of causation.
6	Ignorance of cause confessed.
123	

Further analysis renders this numerical result still more impressive. Few, if any, of those who recognized transient

traumatism as an etiologic factor believed it to be more than an occasional cause, and then only as one which determined the locality of the cancerous invasion. Virchow, Velpeau, and Senn were the most eminent of this group.

Virchow believed "Epithelial cells were formed from proliferation of connective tissue cells," and so would seem to have confounded sarcoma with carcinoma.[1]

Velpeau after declaring that "to patients who refer their tumors (breast cancer) to external violence, it is to be answered that the tumor was pre-existent and violence was the immediate and not the ultimate cause," goes on to say that "the contrary opinion is not untenable, that there may have been some pressure or some forgotten irritation." [2]

Senn mingles sarcoma and carcinoma and says further, that "trauma alone can no more produce a tumor than can inflammation occur without the presence of pathogenic germs" —(and) can only act as an exciting cause in stimulating a persistent matrix of embryonic tissue," etc.[3] In 1901 he states as his "Proposition 14": "Carcinoma seldom follows a single injury but develops more frequently in case of repeated injuries or prolonged continued irritation." [4]

Snow states that "sudden violence may develop malignancy," [5] and later—that "of all causes of the cancer process of every shape mental agonies are the most powerful; exhausting toil and privation ranking next; that they exert a mighty predisposing influence twords the rest, and in case of blows and falls we may doubt the causal relations." [6] Finally he says: "injuries may sometimes be a valid cause, nearly always, however, there are concealed sources of trouble." [7]

Terrier, who was most positive in his belief in traumatic causation of all varieties of malignant tumors, assumed both a cancerous diathesis and a chronic inflammatory process.[8]

It is unnecessary to continue these quotations since none of the writers of this period who regarded sudden violence as a causative factor in cancer attributed to it a wider or more definite influence.

The number of those who believed that trauma might lead to cancer formation but limited this form of injury to continued irritation and chronic inflammation, singly or conjoined, was much greater. It included Critzman, Dennis, Jonathan Hutchinson, Moore, Paget, Rindfleisch, and many others.

Paget states that the whole question of the etiology of tumors is exceedingly involved. In the large majority of cases they are formed without apparent cause. In other instances the connection between the new growth and the alleged cause is exceedingly obscure. In other instances it is very clear, thus—(Examples from irritation—and of immediate sarcoma—none of contusion). In the latter discussion in the London Pathological Society (1874) he further stated that "it is only reading of the same facts (relating to injury) with altered terms which enables us to say that when cancer comes after injury it is because there was a constitutional predisposition to cancer in the patient."

Dennis regards it as "evident that mechanical injury is connected with sarcoma, peripheral irritation with carcinoma, and that sinus or other irritation is associated with epithelioma." [10]

Rindfleisch believes that "whenever a former inflammation has left a tissue *minoris vitæ,* or a part has been weakened by a chronic inflammatory or ulcerative process we must not be surprised to find that arbitrary growth, that wildness in the process of assimilation, which leads to the formation of tumor." [11]

Jonathan Hutchinson declares that "the three propositions in reference to cause which I am chiefly concerned to maintain are: First, that it is a modification of chronic inflammation." ("Second" and "third" concerned heredity and local manifestation.) [12]

These quotations fairly reflect the views of this group of writers, none of whom report contusions or other sudden or transient injuries.

The number of those who ignored extrinsic causes alto-

gether, and ascribed the disease wholly to constitutional conditions or predispositions, was equally large. It included Rokitansky, Cruveilhier, Thiersch, and many others as well as those who accepted special theories of cancer development, as the embryonic, ovarian, or spermatic, in which trauma was an almost if not quite inconceivable element, and still others like Cohnheim in whose theories it was not necessarily excluded. In the remarkable "Cancer Discussion" in the London Pathological Society in 1874 the question was almost exclusively one of local or constitutional origin, and the views of most of the speakers as to traumatic influence can be learned, if at all, only from what they have written elsewhere. No one of the constitutionalists avowed belief in it as an exciting cause; a small number of localists refer to irritation as a local cause, but none to contusion or other sudden violence.

Mr. De Morgan, an avowed localist, had said previously: "Patients with cancer, or who have had cancer removed, have been subjected to injuries and have undergone operations in other situations and for other diseases, but in no case I believe has a cancerous growth taken place in consequence of or in connection with the injury."[13]

Rokitansky states that carcinoma can rarely with adequate reason be attributed to external local causes."[14]

Cohnheim says, "for the statement that any kind of cells increase or proliferate as the result of an external impulse there is no shadow of proof."[15]

The views of constitutionalists are too well known to require further illustration.

The surgeons and pathologists who specifically denied traumatism in any form as a cause of carcinoma more than equal in number those who believed it might result from single and transient injuries; and becomes much greater if there be added those of the constitutionalists who definitely reject all local causes. The writers of this group are notably more positive in the expression of opinion than were those who asserted the causative relation of such injuries as blows and falls.

Moore speaking of the impressions that cancers do sometimes so originate, says: that "no reliance can be placed upon the notions of its supposed proof. It is true that in rare instances an injury is followed by a rapid growth of cancer; but the occurrence is not more frequent than may be accounted for by the accidental occurrence of the injury with an imminent or incipient outbreak of cancer." [16]

Billroth states that "in no single case has a tumor been caused intentionally by chemical or mechanical irritation,—[17] and again—"He (Winewarter) can only adduce 12 cases out of 70 (7.06 per cent.) of mechanical injuries, blows, acting at once in which the declarations of the patient were sufficiently definite to induce belief. He states further that even these few cases gave but little etiological support, since the carcinoma either made its appearance immediately after a blow, or after a long time without the appearance of the phenomena of contusion and chronic inflammation." [18]

Tillmans states that: "first of all there must be present a predisposition of the part in question to the development of a tumor, and it is this which is really the determining cause of a tumor formation." [19]

Evans states: that "the doctrine of the traumatic origin of cancer . . . must necessarily crumble; everything eventually crumbles which is not founded on facts." [20]

These quotations are characteristic of the positiveness of opinion of all writers of this group.

There remain those writers who more or less frankly acknowledge their inability to determine the character of carcinoma, together with those who make no mention of trauma, some thirty-five in all. Twelve of the latter discuss etiology, and as they ignore traumatism it seems fair to infer that they consider it a negligible quantity.

Since the beginning of the present century the literature of cancer has continued to increase in range and extent, but its etiology has still remained the subject of diverse and uncertain opinion. One hundred and fifteen authors of this period, 1901 to July, 1909, have been consulted and have

been classified as were those of the preceding epoch upon the basis of their belief as to the influence of traumatism upon cancer formation.

Number of authors.	Causes assigned.
7	Single and transient injuries.
27	Trauma limited to persistent irritation.
37	Trauma limited to chronic inflammation.
11	All forms of trauma excluded.
12	Undefined trauma.
10	Trauma unmentioned.
9	Exclusive intrinsic causes.
2	Ignorance confessed.*
115	

First. *Of those who are content to believe that single and transient injuries, of which contusion is a type, induce carcinoma.*

Pollaillon, Morton and Hunt, Coley and Armstrong apparently base their conclusions solely upon certain cases which they mention and which will be given later consideration. Coley's paper otherwise refers to sarcoma.

Lejars considers blows, etc., of minor importance; believes predisposition is necessary, and still has doubts on account of possible pre-existence of the tumor or "double action"; he further states that sarcoma is often noted as the result of a single injury.[21]

Creighton quoted statistics, and considers cases of acute malignancy of most significance.[22]

Von Bergmann has no doubt that "a single contusion of the mammary gland may be the predisposing cause for the development of a cancer," and says: "The injury produces an extravasation of blood which remains as a small indurated focus furnishing the nidus in which a cancer develops.[23]

The explanation seems adequate,—it fails only in the fact that there is no evidence that it is true.

Thomson and Miles: "There are some instances of blows

*These beliefs and opinions of surgeons and pathologists of recent years will be given detailed examination.

or other injuries," but "the importance of the rôle played by these antecedent injuries is difficult to determine." [24]

Wakefield: "Contusions of the soft tissues of the female breast . . . may form the initial lesions of malignant tumors in those who have obtained by age, or acquired exhaustion, a normal or premature obsolescence of the glands, probably always characterized by a decline or arrest of the nucleonic oxidation of the cells.[25]

Second. *Of those who recognize an influence of trauma of character undefined.*

Ohlmacher includes trauma with irritation and local inflammation as predisposing, but says search must be made for the real causative agency.[26]

Liall declares that, "Two facts are generally admitted: first, local origin; second, result of trauma or local irritation." [27]

In the light of the present investigation neither proposition is sustained—an example of attention in guise of opinion.

Steingel says, "Cancer of the breast is common after the age of forty, and traumatic influence seems to bear some relation to their occurrence." [28]

Brewer says: "We know very little of cause . . . age and traumatism predispose." (The context shows that he does not distinguish sarcoma from carcinoma.) [29]

Doyen says: "a lipoma, for example, long dormant and stationary, provoked by a trauma, may become malignant, or a myxoma become sarcoma." [30]

Shaw and McKenzie state that in 31.70 per cent. of scirrhous tumors trauma is mentioned, and quotes two cases of assigned traumatic nature." [31]

G. K. Bigg says: "The exciting causes are injury or disease." [32]

Cripps speaks of "acute traumatic malignancy," and quotes two cases.[33]

Ziegler says: "It has been reckoned that in about 7 to 14 per cent. of cases of tumor traumatic origin can be assigned, particularly in cases of sarcoma, osteoma, and carcinoma." [34]

Wolff declares "trauma constitutes only an indirect cause of cancer, and that in very few instances."

Whipham states, that in 650 cases there was previous injury in 6 per cent.[35]

Sobre-Casas has reflected belief in a traumatic causation, formed from statistics and a supposed general concurrence by surgeons.[36]

The authors enumerated above comprise all those accessible to the writer, who since the beginning of the present century have in any manner by direct assertion or by inference accepted transient injury as a cause of carcinoma.

Third. *Of those who recognized trauma as a cause of carcinoma, but only when limited to persistent irritation or to chronic inflammation.*

These are sixty-four (64) in number and include Da Costa, Delafield and Prudden, Lexer, Menetvier, Nichols, and other eminent pathologists. It will be unnecessary to quote them seriatim, as the influence of this particular form of injury is more generally conceded. Some of them rely exclusively upon continued irritation, and others assert an intervening inflammation, while a much smaller number make inflammation the primary condition. A large proportion of them refer to a single traumatism as a producer of sarcoma.

Vaughan—" Etiology of Tumors "—age, race, sex, injury or irritation, as the occurrence of sarcoma after fractures; tumors of the lip or tongue from the irritation of a cigar or pipe stain or bad teeth, or their development at constricted points as the pylorus, etc.[37]

Delafield and Prudden: Bruises or contusions, particularly those involving the bones, are not infrequently followed by malignant tumors; and it is noteworthy that these tumors are most apt to be of the connective-tissue type—sarcoma, osteosarcoma, chondroma, etc. Epithelial tumors on the other hand are more frequently developed at the seat of repeated injury or long-continued irritation.[38]

Da Costa: " Injury and inflammation may undoubtedly prove the exciting cause. A blow is not infrequently fol-

lowed by sarcoma; the irritation of a hot pipe-stem, scratching of a jagged tooth, etc., may cause cancer." [39]

Bashford: "Three instances of irritation are crucial in man." (1) "Cancer of skin of abdomen, practically unknown in Europe, frequent in Kashmier owing to the fact that natives of that country irritate the abdominal walls by wearing a charcoal oven around the waist." (2) "Cancer of the floor of the mouth, rare in European women, is very common in Ceylon and India where the women chew betal nut and sleep with the plug in the cheek at the exact spot where the cancer starts." (3) "In needlewomen melanotic sarcoma often starts at the site of frequent puncturings by the sewing needle." [40]

Alendron: "The predisposing factor is lowered vitality; chronic irritation no matter of what character is the determining factor . . . cells of tissue irritated, unable to respond normally to the irritant, assume characteristics suitable to their environment; thus conforming to a natural law." [41]

Rountree: "Probably two essential conditions for the formation of squamous cell cancer are: first, the presence of a mass of epithelial cells; and second, a surrounding area of connective tissue in such a special condition as to render it vulnerable to epithelial invasion." "Cancer produced from X-ray, also numerous conditions of chronic irritation." [42]

Bonney: "There is a precancerous condition of subepithelial chronic inflammation." [43]

Menetvier: "It is only believed to-day that reflected traumatisms, chronic irritations and inflammations, are effective causes of cellular proliferation; and that this rightly constitutes the anatomical substratum of a cancer tumor." [44]

Fourth. *Of those who consider only intrinsic causes.*

These include writers who have suggested or accepted special theories of cancer development, as well as others who without adherence to any particular theory discuss only constitutional conditions. The advocates of special theories do not in general raise the question of traumatism, though in

many instances such a contingency is conceivable; as, for example, in Bonney's theory of subepithelial inflammation, or in embolic germatoid, or katabolic hypothesis. In the present study, however, it is only the expression of opinion which is in question, and when theorists have expressed opinions in regard to traumatism they have been classified with their co-believers. No effort has been made to make complete the list of recent authors who have confined their discussion of cancer to abnormal cellular proliferation.

Fifth. *Of those who disbelieve in any form of traumatism as a cause of cancer.* These will be quoted seriatim.

W. Hutchinson: "Even the irritation or injury theory has been found in the light of broader data to depend upon the familiar confusion between *post hoc* and *propter hoc*. . . . In view of . . . the effect of irritation in causing even this form of cancer (smokers and chimney sweeps') seems on the whole problematical." [45]

Woodhead: "From time to time there have been put forward numerous causes of tumor formation; irritants of various kinds, general or specific, have all had their day . . . might advance a whole series of other forms of irritant, mechanical injury among others." [46]

Hewlett: "We are still in the position of knowing very little causation of new growths. . . . Active cell division and proliferation occur only in conditions in which the cells cannot fully utilize the assimilated material in the performance of special functions." [47]

Jacobson: (We) "may conceive of a parasite as an incidental factor; may also conceive of a misplaced embryonic cell, as constituting *per se* a competent source of irritation, without introducing assumptions of additional factors in traumatism." [48]

Adami: "It is not something from without that determines the continued growth, not an external stimulation." [49]

Lancet Editorial: "The many theories which have in recent years been advanced . . . all fall into one of two catalogues—parasitic invasion, or some habit of the individual,

diet, etc." Which is much the same as saying it is a disease of civilization." [50]

Ruelff: "We come to the conclusion that the real cause of cancer is, age. All other causes, such as trauma, inflammation, etc., which heretofore have been considered as important etiological factors may be regarded as coincident factors." [51]

Cole: "Injury, however, frequently calls attention to a previously existing condition." [52]

Roger Williams: "It seemed to me that injury was often only the means of directing the patient's attention to the primarily existing disease of which she had been until then unconscious. . . . I regard the relation of trauma to cancer . . . as resembling that of a spark in contact with combustible matter; the result depending upon the latter rather than upon the spark itself." [53]

Lacine: "We believe the relation of cause and effect between trauma and the appearance of a tumor cannot be rigorously established." [54]

Laker: "The traumatic theory assumes that trauma and irritation of various kinds provoke malignant neoplasms and its defenders arrive at that conclusion from the observations submitted that cancer follows trauma. How little that theory offers from an etiological viewpoint is apparent from the indefiniteness of what constitutes irritation and trauma. None of the so-called proof furnishing observations will stand a strictly analytical criticism. . . . It has been believed that not only chronic irritation but also a single trauma, such as contusion or a blow, will cause cancer. This is allied to the notion that tuberculosis is caused by taking a cold drink. . . . There is no doubt that patients frequently have their attention called to the presence of a neoplasm because of a trauma which develops pain and inflammation in the situation where the neoplasm is located." [55]

As among the authors of the previous century, in this there are also a certain number who cannot be classified in either of the groups which have been considered. They

are those who have not included etiology in the scope of their subject, and those who have unqualifiedly stated their belief that the causation of cancer is as yet an unsolved problem. The latter, who have been characterized by a very enthusiastic believer in infection as "dilettanti agnostics, men without open mind who know nothing," include Bland-Sutton, Richard Douglas, and the Editor of the *British Medical Journal,* with others, and to these might be added many who with hesitating opinions have very nearly declared themselves of the same mind. Douglas who has written very recently is emphatic. He says: "We are yet in total ignorance concerning the etiology of cancer. This statement is made with the full knowledge of recent bacteriological work from which much may be hoped; but nothing conclusive has yet developed." [56]

Bland-Sutton is no less clear in his conclusion.[57]

It will suffice to conjoin a summary of various opinions, beliefs and assertions as they concern traumatism in the etiology of cancer to the period extending from the middle of the last century to the present time. Views held prior to this period were so generally influenced by conditions which no longer exist or by obsolete theories that they cannot be supposed to affect present professional opinion.

SUMMARY—1851–1909.

Number of authors	Causes assigned.
22	Single or transient injuries.
43	Trauma limited to persistent irritation.
45	Trauma limited to chronic inflammation.
12	Undefined trauma.
28	All forms of trauma excluded.
36	Trauma unmentioned.
35	Exclusive intrinsic causes.
9	No theories of causation.
8	Ignorance confessed.
238	

This summary is sufficiently extended to prove that only a small minority of authors (9 per cent.) have at any time

stated that in their opinion or belief transient injuries, such as blows or contusions, may be a cause of cancer. An examination of the individual utterances of this small minority will perhaps show that the greater number of those who admit its possibility believed it to be no more than an accessory to an essential cause pre-existent in the constitution of the patient. It is pertinent to this inquiry into the present state of professional sentiment to note that the only recognition of a single or transient traumatism as a cause of cancer from the time of Bergmann (1904), nearly five years, is in the statement of Thomson and Miles previously quoted, which after asserting that there are "Some instances in which there is a definite history of a blow or some injury 'preceding' the appearance of the tumor," adds very guardedly that the rôle played by these antecedent injuries is "difficult to determine."

It is also worthy of note that four authors of the present period, each of a different nationality, Laker, Menetvier, Rodman, and Roger Williams, who have written most systematically and exhaustively of cancer, all exclude the influence of this form of trauma.

Laker and Williams exclude traumatism altogether; Rodman and Menetvier confine it to repeated injuries, continued irritation, and chronic inflammation.

In the survey of so large a field it is perhaps unavoidable that some errors of reference or of inference should occur. In the present instance, however, it is believed that if there have been such inaccuracies they are immaterial, that quotations have correctly represented context, and that the conclusions stated are inevitable.

This investigation can have no more than a curious interest from a professional point of view since there are no authorities in medicine or surgery as there are in law. It is also to be borne in mind that opinions are conclusions formed upon a substantial basis of facts, and are not to be confounded with mere assertions.

The writer of this article has refrained from referring to

his own experience. He has no records of histories of cancer cases which have come under his care, and is unable even to approximate their number; but in the course of a surgical experience in large hospitals as well as in private practice extending over many years it has necessarily been large. He has had in no instance reason to attribute cancer formation to contusion from blow, fall or other sudden violence.

The popular belief that a cancer of the breast can always be traced to some contusion or other trivial injury has existed to a very great extent; and where entertained has been held with a tenacity which seems to have hypnotized attending physicians into accepting even improbable assertions as undoubted facts. The fallacy of confusing *post hoc* with *propter hoc* and the unreliability of patients' logical processes has been again and again pointed out even by those writers who concede trivial injuries to be really capable of producing cancer. The more or less apocryphal histories obtained from patients, either singly or reduced to statistical form, seem to have been wholly relied upon to support the hypothesis of mechanical violence as a causative influence in this disease. It would be a useless task to attempt to average or to reconcile the statistical conclusions of different authors. Williams found in 1000 cases personally observed only one in which malignant disease immediately followed injury, a case of so-called acute malignancy and therefore probably one of sarcoma.[58] Paget declared that the "sum of all predisposing causes of cancer is insignificant."[59] Bowlby states that "careful analysis has shown that in not more than 2 per cent. of all tumors can injury be certainly traced as even a possibly exciting cause."[60] Winewarter estimated at 7.6 per cent., Boll at 12 to 14 per cent., Wolff at 29 per cent., a writer quoted by Lexer at 44.7 per cent., and Loëwenthal at 60 per cent., as the percentage of cases in which cancer was preceded by an injury which was presumably its cause. Loëwenthal's cases were all of mammary cancer, some arising after an interval of ten years. Dieffenbach states that trauma preceded neoplasm in 90 per cent. of 300 cases of cancer in the Flower Hospital

and in private practice; and adds "Off-hand questioning often results in negative replies, but persistent and careful questioning as regards habits, occupation, etc., usually elicits some kind of trauma or irritation to which the patient frequently attached no importance."[61] The same explanation might probably apply to others of the high percentages.

The size of the percentages seems to depend upon the credulity, prepossessions, and it may be discretion of the statistician. The results are confessedly attained in each instance by discarding a certain number of cases upon such grounds as seemed good to the inquisitor. It would be hardly possible to accept every history at its face value, though it will be seen from cases to be cited later that some writers have been most indulgent and comprehensive in their estimates. Statistical results thus derived are at best of doubtful significance, and can have no value in arriving at logical conclusions.

It is, after all, a question of direct evidence—of an appreciation of the facts disclosed in an examination of cases which have been cited from time to time as proof that cancer can be produced by a transient traumatism—that is to say by a contusion however caused, whether by blow or fall or a collision with an inanimate object.

So far as practicable all writers upon this subject of cancer from 1850 to the present time have been consulted with reference to these supposed demonstrative cases, and excluding sarcomata, duct cancers from irritated nipples, and long continued occupation pressures upon the male breast, less than two score (34) have been discovered. These cases may be grouped as follows.

I. Those dependent upon vague impressions of the patient, and those in which tumors appeared some years after the alleged injury.

II. Those with a history of primary inflammatory changes, or of a notable hæmorrhagic extravasation.

III. Those of the class of so-called "acute traumatic malignancy."

In Group I these cases were eighteen (18) in number and

were only connected with traumatism as indicated by the following quotations: "Attributed to a blow from a stone." "Says he was injured by a fall." "Ascribed to a blow received 26 months before." "Tumor in right breast, several months prior to which a painful tumor had existed in the axilla." "Thought to have been produced by an injury attributed to a kick." "Assigned cause was of transient nature in 15 of 41 cases"—*e.g.*, "ascribed to blows received two years previously." "Four cases with history of injury shortly antedating discovery of lump." "Tumor at end of two years." "Tumor three years later." "Ascribed to blows received two years previously." "Thinks a slight bruise four years ago." "Ten years previously struck the breast; tumor eight months later at base of axilla." "True cancer twelve years after injury and primary cyst."

The cases thus presented are so obviously without value as evidence as to require no comments.

In Group II there were 7 cases in which primary inflammatory process or hæmorrhage was indicated. In 2, abscess of the breast followed injury, scirrhous in one and cystic in the other respectively twenty-two and twenty-seven years later; in a third there was immediate swelling of the breast which later became hard; in a fourth, a soft fluctuating tumor of the breast was discovered on the fourth day; in a fifth, the blow was severe, active treatment was required for primary symptoms, and at the end of five months a scirrhus of the breast with a central cyst was removed; in a sixth, an immediate swelling of the breast assumed characters of scirrhus, and on its removal remnants of effused blood surrounded by a cyst wall were found; and in the seventh a blow upon the breast was followed six months later by a swelling which steadily increased in size and became painful; the skin was marked by scars of old abscesses and was inflamed in the axillary region; the axillary glands were not enlarged; the inner part of the breast continued a hard mass which was "undoubted cancer," infiltrated with blood and breaking down superficially.

In Group III there were 9 instances of so-called "acute traumatic malignancy." The exact nature of cases included under this name is not always clear; but, in general, rapidity of formation after an injury seems to have been made an essential point, though the limit of time has not been definitely fixed. Barwell is more definite in his understanding of the conditions which exist: "Under the stimulus of severe irritation the tissue elements, which under favorable circumstances would assume only the additional activity necessary for repair, may take on a more prolific cell germination culminating in a rapid form of malignant disease—be it named myeloid or round-celled sarcoma or encephaloid cancer, which consists of but little else than heaped up cells and their progeny.[62]

These tumors in the great majority of cases, if not in all, are sarcomata; as were both of Barwell's and all but two of Coley's, and as was Williams', and probably Paget's in vew of its location.

The cases cited in which this condition assumed a carcinomatous form were: Broca, 2 cases (quoted by Rioland and others); Coley, 2 cases; Shield, 1 case; Cripps, 1 case; Paget, 1 case ("possible"—quoted by Barwell).

There are two other cases which may perhaps be added, though in one the culmination was long deferred and in the others the history was incomplete. In the first a bloody discharge from the nipple occurred at once which continued till time of operation three years later; in the second the nipple was struck with a broom handle, and the tumor was discovered at the end of six months. Microscopic examination was made in neither case.

There remain three cases which are referable to neither of the classes which have been named. Two of them were instances of cysts with carcinomatous deposit, infiltrating the cyst walls in one, and occurring as a distinct mass in the posterior wall of the other. The cysts may have been blood formations from the injury received in either case, or may have been simple coincidences, but the injury could have had no concern with the disintegration which occurs in all cysts

as it does in all tumors. The history of the third case merely states that "an old lady was struck in the back by a tennis ball, and where the ball fell there formed a large and quickly growing carcinoma." This may or may not have been another instance of acute traumatic malignancy.

These several classes of cases differ in their interpretation. The influence of single contusion upon cancer formation which was found to be so generally excluded by writers upon the subject has not been demonstrated in any of the cases cited in the way of illustration. The alleged relation of the disease has been in every instance so vaguely stated, or its effect claimed to be operative over so great a length of time, and in either case without any attempt having been made to establish a connection between the two, that the professed demonstration is wholly inconclusive. It has been inferred by a few writers, and even directly stated in some recent medical proceedings, that a causative effect may exist for an absolutely indefinite number of years after an injury has been received. The logical absurdity of such a claim made without even an assumed connecting link, and ignoring the possible intervention of any one or more of a myriad of equally credible causes would seem to be self evident.

If it were necessary to go further it might be pointed out that there is no rational explanation of why such an injury should at some later time lead to radical changes in the processes of cell proliferation; that no possible connecting link has been suggested, except it be in v. Bergmann's entirely fanciful theory; that the more extended and carefully compiled statistics have been, the smaller the percentage of even antecedent injuries of this character has been found to be; and that while contusions more or less severe are of constant occurrence in every part of the body, it is only exceptionally and when confined to the female breast that they have been supposed to produce carcinomata. Exceptions to the last statement may be found in a very small number of cancerous tumors of the male breast, and a still smaller number of abdominal cancers, which have been attributed to contusions.

These considerations and others have been more fully set forth by Williams [63] and need not be repeated.

The existence of a precancerous condition of continued pressure or irritation or of chronic inflammation is quite another matter. There is no interval of time to bridge over and the succession is capable of rational explanation. A continuous morbid process is demonstrated; a new tissue is formed; and all abnormal benign tissues are liable, if not prone, to degenerate; even lipomata are not exempt. Fibro-adenoma of the breast if left to itself, or even when recurrent after removal, almost habitually becomes malignant; and epithelioma of the lip, still more frequently, is seen to pass from mere irritation to a benign growth, and from that to a malignant form of disease. Chronic mastitis after lactation in a variously estimated proportion of cases is transformed into scirrhus; and there is no apparent reason why the same plastic exudation when provoked by violence should not undergo the same transformation. There is reason, therefore, to accept at their face value those cases in which trauma of whatever character when causing inflammatory exudation is apparently the indirect cause of malignant degeneration.

The dependance of acute traumatic malignancy upon sudden violence is less readily explained, and still less readily the occasional instances in which it assumes the form of carcinoma rather than of sarcoma. The rapid sequence of events fairly indicates the potency of the injury as the exciting cause; but the precancerous stage of inflammation has not been shown to exist; and the clinical history no less than the characters of the tumors as described by Barwell [64] further indicates a "rebellion of the cells," "a wildness of assimilation," so far out of proportion to the usual triviality of the injury that we are compelled to invoke some ulterior cause to account for the malignancy of the outbreak. This can only be a constitutional predisposition to the disease so intense as to respond with disproportionate violence to an insignificant provocation. Such an abnormal relation of all exciting cause to a constitutional condition is not unparalleled. A slight exposure to cold may

result in a pneumonia so malignant as to be obviously destined to a fatal ending from its very inception; or a single case of typhoid fever in a mild epidemic may assume the malignant form from its onset.

That any form of unknown constitutional condition or predisposition is the essential cause of cancer even those who are most positive in their belief in the influence of some form of trauma, whatever it may be, have not hesitated to admit. The localists as opposed to the constitutionalists in the "Cancer Discussion" in the London Pathological Society[65] did not deny its reality, but only its localization either in the blood or in the solid tissues of the body. Its characterization by Mr. De Morgan in the course of that discussion as an "all pervading condition which will sooner or later find its local expression in altered nutrition, new growth, etc., defines it with as much precision as seems possible. It is intangible, and like nerve force it is beyond description and recognizable only in its effects.

The presence of an excitant even is not necessary for its manifestation. The great majority of cases are spontaneous; that is, they occur without manifest cause. Individual writers who have been enamored of a theory have attributed cancer formations in general to some single cause, as heredity, mental disorder, physical debility, errors of diet, etc.; but it is still the general consensus of opinion that those conditions like age and sex are conditions which favor rather than cause their development. If the parasitic theory, which may be considered as yet *sub judice,* be discarded, the approximate cause of the interruption of orderly cell proliferation which transforms an irritated surface, an inflammatory exudation, or a benign tumor, into a malignant growth must still remain a mystery.

It would seem from a general observation of cases and from a comparative study of discordant statistics that it may be concluded:

1. That cancer is primarily dependent upon a cause which is congenital, is hereditary in a certain proportion of cases, and is as inexplicable as the force which determines *ab ovo* the future sex and peculiarities of the individual.

2. That its development is favored by various indeterminate and non-essential conditions.

3. That its proximate cause is as yet entirely unknown, and that its future determination will depend upon the possible verification of a parasitic infection.

These propositions are supported by the frequent occurrence of the disease in persons who are still in early or middle life, without hereditary predisposition, and in absolutely normal and mental equilibrium; and this in the absence of any of the accepted favoring conditions.

REFERENCES.

[1] Quoted from Nurin.
[2] Traité de Maladies du Sein, p. 542, 1853.
[3] Pathological and Surgical Treatment of Tumors, p. 68, 1895.
[4] Jour. Am. Med. Association, vol. ii, p. 808, 1901.
[5] Clin. Notes on Cancer, p. 94, 1883.
[6] Cancer and Cancer Progress, 1893, p. 35.
[7] Twenty Years Experience in Treatment of Cancer, etc., p. 39, 1898.
[8] Eléments de Pathologie chimique, 1885, p. 23.
[9] Holmes Surgery, third edition, N. Y., 1883.
[10] System of Surgery, 1895–6, p. 18.
[11] Elements of Pathology, 1884, p. 42.
[12] Surg. Affections of the Trunk, 1890, p. 138.
[13] Origin of Cancer, 1872, p. 13.
[14] Sydenham Society, 1854, p. 255.
[15] Lects. on General Pathology, 1886, p. 756.
[16] Holmes Surg., 1870, p. 581.
[17] Surg. Pathol., p. 575, 1874.
[18] Diseases of Female Mam. Glands, p. 137, 1887.
[19] Surg. and Surg. Pathol., p. 739, 1894.
[20] Cancer and its Many Theories, p. 1, 1896.
[21] Traité Pathol. Gén., 1902, p. 558, *et seq.*
[22] Cancer and Other Tumors of the Breast, 1902, p. 277.
[23] System Pract. Surg., p. 589, 1904.
[24] Man. of Surg., p. 300, 1909.
[25] Katabolic Pathology of Cancer, 1902, p. 31.
[26] Am. Text-book of Pathol., pp. 170–216, 1901.
[27] Medical News, Present Status of Cancer, Etiol., etc., Sept., 1902, p. 4.
[28] Text-book of Pathol., p. 761, 1903–6.
[29] Text-book Surg., 1903, p. 71.
[30] Etiol. et Traitément du Cancer, p. 33, 1904.
[31] 41 Cases of Cancer, 1906.

[32] Cancer, p. 14, 1907.
[33] Cancer of the Rectum, p. 27, 1907.
[34] Gen. Pathol., pp. 16–376, 1908. Written 20 years earlier.
[35] Jour. of Pathol. and Bacteriol., 1908.
[36] Le Cancer, Prophylax., Etiol. et Trait., pp. 33–91, 1908.
[37] Principles and Practices of Surgery, p. 186, 1903.
[38] Handbook of Patholog., p. 297, 1904.
[39] Modern Principles of Surgery, p. 299, 1907.
[40] Report, Research Fund, vol. ii, p. 1185, 1908.
[41] N. Y. Med. Jour., vol. lxxxvii, p. 227, Abs., 1908.
[42] Hunterian Lect., Royal Coll. Surgeons, Lancet, vol. I, pp. 824–821, 1909.
[43] Hunterian Lect., Royal Coll. Surg., 1908.
[44] Cancer, pp. 512–14, 1909.
[45] Studies in Pathol., pp. 202–04, 1901.
[46] Recent Investigations on Cancer, p. 645, 1907.
[47] Pathol., General and Special, p. 69, 1907.
[48] Cancer and Cure of Cancer, Med. Rec., vol. lxxvi, p. 558, 1907.
[49] Principles of Pathology, p. 797, 1908.
[50] Vol. i, p. 217, 1907.
[51] Das Problem das Krebses, 1907.
[52] Mobile Med. and Surg. Jour., vol. xii, p. 16, "Diag. and Treat. of Abnormal Breast Conditions," 1908.
[53] Nat. Hist. of Cancer, p. 287, 1908–9.
[54] Précis de Pathol. Chim., tome i, p. 149, 1909.
[55] Ueber das Wesen und die Heilbarkeit des Krebses, 1906 (Haubold, trans.).
[56] Surgical Diseases of the Abdomen, p. 97, 1909.
[57] Keen's Surg., p. 773, 1906: Tumors Innocent and Malignant, p. 270, 1907.
[58] Nat. Hist. of Cancer, p. 287.
[59] Lects. on Surg. Pathol., vol. ii, p. 330.
[60] Surgical Pathol. and Morb. Anat., p. 143.
[61] Med. Rec. Roëntgen Ray and Etiology of Cancer, vol. i, p. 5–18, 1909.
[62] Barwell: Acute Malignancy.
[63] Loc. cit.
[64] Loc. cit.
[65] Loc. cit.

SKELETAL CARCINOMATOSIS.*

WITH REPORT OF A CASE.

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THE following case is of interest because carcinoma of the bones is not often recognized or suspected during life. Carcinomatous disease of bone has received little attention from the fact that it does not cause sufficient changes in the architecture of bone to excite clinical notice. Only rarely are any gross osseous lesions found, which accounts for the fact that few cases have been submitted to radiographic examination. Moreover, the subjective symptoms which accompany this disease are not distinctive, and tend to confuse it with more common affections. It is also apt to be overlooked for the reason that carcinoma of bone is never primary, but always secondary to a growth in some epithelial organ, usually remote.

In the case which I report, an accident (spontaneous fracture), not frequently occurring in carcinoma of bone, led to the discovery of bone disease, and the history of breast cancer gave a clue to its probable nature.

Mrs. S., apparent age 55 years. Began in July, 1907, to notice a gradually increasing feeling of general weakness, with sharp attacks of pain in right breast. In October she began to have pains in the legs and lower lumbar region. These pains continued more or less constant, and the weakness gradually increased so that she had difficulty in walking across a room. Finally, in December she became bedridden, and a month later was removed to St. Vincent's Hospital, Bridgeport. At that time she weighed 180 pounds. Pains in legs and back subsided somewhat, but the hospital chart states that pain in the breast was often severe. In February, 1908, the breast was amputated for cancer. The hos-

* This term, suggested by von Recklinghausen, has been chosen for the reason that it expresses more accurately the nature of the anatomic changes in the bones.

pital record shows that patient still complained of weakness, pain in the back, legs and sometimes all over the body. At one time pain was referred to the left hip. Eighteen weeks after the operation she began to walk, but had great difficulty in doing so, even with support. After several weeks' attempt to get about she was forced to spend most of her time in bed.

About one year after the breast operation, while standing in a bathtub, the left leg suddenly gave way, with an audible crack. Three months later she felt something give way in the right thigh as she was being lifted from a bed pan. Swelling about the hip followed the injury to both legs.

Examination October 22, 1909, shows a thin, anæmic woman. On the right side of the chest is a long cicatrix extending well up into the axilla. At the upper end of the scar are a few small, hard nodules and a large one in the axilla. In the left breast there is a hard nodule.

Both legs appear short and distorted; the left lies in normal extension and rotated outward 90°. The thigh appears to bulge forward very much like anterior bowing of the femur in rickets, making the inguinal fold very deep. Active motion is very limited and only slight passive motion was attempted because of pain. Palpation reveals the shaft of the femur extending upward and ending abruptly one inch below and somewhat anterior to the spine of the ilium, which lies hidden in the deepened inguinal fold. In the region of the trochanter is a large irregular mass of bone which rotates with the shaft.

The right leg lies flexed at 160°, adducted and rotated inward 90°. The thigh appears symmetrically enlarged above. Active motion slight. Passive motion gives patient fear that leg will break. On palpation there seems to be a uniform enlargement of upper end of the femur, extending from upper third into trochanter which seems enlarged, but in normal position, and rotates with the shaft. Measurements were not attempted because of the distorted, fixed position of the legs.

Further skeletal examination revealed a moderate total lateral curvature of the spine to the right; tenderness over the third and fourth lumbar vertebræ, and over the condyles of right femur. There was tenderness also over the seventh and eighth ribs on left side, and under the pressure of the examining finger the seventh rib caved in with the feeling of crepitus.

The blood examination, made by Dr. Patterson, resulted as follows: Hæmoglobin, 75 per cent.; R.B.C., 3,172,000; W.B.C., 7,300. Differential count: Polynuclears, 63 per cent.; small mononuclears, 27 per cent.; large mononuclears, 10 per cent. No eosinophiles or myelocytes found in specimens examined. Red cells uniform in color but varied slightly in size and shape. One nucleated red seen.

Radiographs taken by Dr. Fleck show a fracture of the left femur (Fig. 1) about 4 inches below the trochanter, with considerable callus formation, overriding and angulation, also irregular areas of osteoporosis in the shaft and neck. The radiograph of the right hip (Fig. 2) shows a fracture just below the trochanter with the fragments united at a right angle; also honeycombing of the shaft, neck, and trochanter. Other exposures made reveal similar areas of softening in both fibulæ and two ribs.

Frequency of Carcinoma in Bone.—Von Recklinghausen, in 1891, was the first to make any careful study of carcinoma of bone. This he did in the course of his investigations upon cancer of the prostate. He noted, with surprise, the frequency and peculiarity of skeletal metastasis in prostatic carcinoma. He states that this discovery was accidental, due to the finding in one case of a small tumor of the frontal bone. Otherwise, he adds, the bones would not have been examined.

Kaufmann, who later investigated this subject, pointed out the fact that cancer of bones followed with surprising regularity cancer of the breast, thyroid and prostate; that in the great majority of cases it was secondary to carcinoma in one of these three structures; and that it never developed primarily in bone tissue. Limacher, who has studied the metastasis in mammary carcinoma, found the bones involved in 14 per cent. (1 in every 7 cases).

Leuzinger, who has investigated bone lesions in cancer of the thyroid, found secondary deposits in the skeleton in 37 per cent. And Kaufmann, in his own 22 cases of prostatic cancer at the Basle Institute found bone metastasis in 16 (72 per cent.), and in his 100 collected cases, many of which were taken from the literature and lacked complete details, bone involvement was recorded in 34.

FIG. 1.

Radiograph by Dr. H. W. Fleck, from Saint Vincent's Hospital, Bridgeport. (Postero-anterior exposures of hips were made because of the apparent anterior position of the upper end of each femur.) Showing fracture about 4 inches below trochanter. There is considerable overriding of the fragments and some angulation. Areas of rarification are seen in the neck and throughout the callus, with larger areas in trochanter and shaft.

FIG. 2.

Radiograph of right hip by Dr. H. W. Fleck, from St. Vincent's Hospital, Bridgeport. (Same method of exposure as in Fig. 1). Showing fracture just below trochanter, overriding, and fragments united at an angle of 90°. Fine honeycombing in the neck with large areas of osteoporosis in shaft.

FIG. 3.

Case by Dr. W. P. Healy. Radiograph by Dr. L. G. Cole. Showing old fracture of left femur with callus, and recent fracture just above; also irregular areas of softening in the shaft and old callus.

FIG. 4. FIG. 5. FIG. 6.

FIG. 4. Excessive osteoplastic "carcinose" of the pelvis. (After Kaufmann. Case VIII. From the collection in the Basel Pathological Institute). In this case the clinical diagnosis was carcinoma of the prostate and bones; the prostate was the size of a hen's egg and contained small cancer nodules, with metastases in pelvis, lumbar vertebræ, ribs, sternum, left femur, and right humerus.

FIG. 5. Unusual osteophytic outgrowth on the posterior surface of the left humerus. (After Kaufmann. Case V.—Basel Collection.) In this case the lumbar vertebræ, femur, sternum, and ribs were involved.

FIG. 6. An uncommon type of cancer deposit (solitary nodule) in the lower end of the right femur. (After Kaufman. Case III.—Basel Collection.) The symptoms in this case were pain in right leg and hip, and the clinical diagnosis was chronic rheumatism; the prostate was moderately enlarged inclosing two cancer nodes; carcinoma deposits in lumbar vertebræ, ribs, femur, humerus, tibia, and skull (osteoplastic).

FIG. 7. FIG. 8.

FIG. 7. Osteoplastic "carcinose" of the head and upper end of the right humerus, showing miliary osteoporosis in the head and neck, and small growths of new bone in the central canal. (After Kaufmann, Case III. —Basel Collection.)

FIG. 8. Osteoplastic "carcinose" in the right tibia—in part osteoplastic and part osteoclastic. (After Kaufmann. Case III. —Basel Collection.)

FIG. 9. FIG. 10.

FIG. 9. Longitudinal section through a carcinomatous rib. (After Kaufmann. Case IX.—Basel Collection.) In this case metastases also in the pelvis, vertebræ, right femur, and right humerus.

FIG. 10. Part osteoclastic, part osteoplastic "carcinose" of the vertebræ—fifth dorsal to second lumbar. (After Kaufmann. Case VIII.—Basel Collection.)

Pathology.—Following von Recklinghausen's careful study of the pathology of carcinoma in the bones in five cases, Cone published in detail the post-mortem findings in a case taken from Halsted's clinic. Still later, Kaufmann made a comprehensive investigation of 34 cases. Although these were all cases of prostatic origin, Kaufmann found that the behavior of carcinoma in the bones is practically the same whether secondary to a growth in the breast, thyroid or prostate, or, as more rarely happens, from the uterus and stomach.

The work of these investigators has placed the pathology of this disease upon an intelligent basis. They found that invariably more than one bone was involved, usually six or eight, and that cancer with notable regularity invades certain bones. The favorite sites found were: The vertebræ (particularly the lumbar), the femur, ilium, ribs, sternum, humerus, skull, sacrum and tibia. Thus, Kaufmann in his 34 cases found the lumbar vertebræ involved in 27, the dorsal in 19, the femur in 23, the ilium in 21, the ribs in 19, the sternum in 12, and the skull in 11.

Von Recklinghausen found that the invasion began in marrow, which was usually found studded with nodules of cancer tissue. In the long bones these occurred most frequently in the expanded extremities; in the vertebræ throughout their bodies. This is in accord with the theory that the invasion of bone occurs via the blood stream, since Lexer has pointed out that the metaphyses are the most vascular parts of bone.

These cancer nodules usually found in groups, rarely attained any great size. Occasionally it was more miliary in character.

This invasion of the marrow leads to a low-grade osteoporosis (called by von Recklinghausen, "osteomalacia carcinomatosa") which often extends from the central canal to the periosteum, with nests of cancer cells scattered throughout the Haversian canals. Extension to the periosteum is productive of a fibroperiostitis with formation of new bone. New bone formation also occurs in the marrow. These two pro-

cesses, osteoclastic and osteoplastic, as a rule, are not productive of extensive alteration in the architecture of bone. Kaufmann remarks on the slow, restricted growth of this neoplastic disease. In the majority of his 34 cases the disease was usually limited to a comparatively small area in an otherwise healthy bone; only occasionally did the external surfaces show evidence of disease and then generally as a superficial, irregular deposit of new bone not unlike callus formation. The destructive lesion within usually showed localized areas of softening with some thinning of the external walls. In no case did he find penetration of the periosteum and extension into the soft parts or into a joint cavity. In only a few cases had spontaneous fracture occurred, and in only three were osseous tumors found of sufficient size to be detected clinically.

Grunert, in a comprehensive monograph on spontaneous fractures in which he mentions carcinoma and sarcoma of bone as common causes, describes the lesion as a general osteomalacia, a general diathesis of bone. He states that cancer tissue may or may not be found at the site of fractures; but he records only four cases, in which there is report of autopsy in only two, and in these the post-mortem examination appears to have been incomplete.

Symptoms.—I have been able to find but very little in the literature bearing directly on the symptomatology of this disease. What I have obtained has been gleaned from the histories of reported cases, in the majority of which the presence of bone disease was accidentally discovered at autopsy.

In almost all the cases pain has been a prominent symptom. In most instances the pain has been referred to the back, in many to the extremities, and in some it has been general. Usually it has been more or less constant and occasionally severe. Almost invariably, it has been called myalgia, lumbago, sciatica, or chronic rheumatism. This is illustrated in a case reported by Ganau, in which a man of 70 suffered pain in the sacrum and both legs. The clinical diagnosis was chronic rheumatism, but autopsy revealed carcinoma in the

lumbar vertebræ, ribs, femur and humerus, and small cancer nodules in a slightly enlarged prostate. In another case by von Frisch, pain in the back was treated for lumbago for several years, where post-mortem examination demonstrated deposits in the vertebræ, sternum and skull, secondary to a small cancer nodule in an atrophic prostate.

In some cases general bodily weakness has been a prominent feature. Occasionally it has been the principal subjective symptom. In the case reported here, the patient became so weak shortly after the onset of pain that she could hardly walk a few steps, although she had not then lost in weight.

Tenderness over bones has been reported in a few cases. Among Kaufmann's cases tenderness was noted over the spines of the vertebræ, also over the sternum, ribs, sacrum, and trochanter of the femur.

Gross tumors springing from the bones have been few. Out of his collection, Kaufmann reports but three. One was von Recklinghausen's case, which presented a small tumor of the frontal bone, another was a tumor of the ilium in which the clinical diagnosis was sarcoma, the third was Cone's case, in which a leg was amputated for a tumor of the tibia. Dr. J. C. Bloodgood, in a personal communication, mentions a case in which amputation at the shoulder joint was done for carcinoma of the humerus.

Spontaneous fractures do not occur as frequently as might be expected. Kaufmann found it in four out of thirty-four cases. In one a rib and femur were fractured, in another both clavicles. Grunert in his work on spontaneous fractures mentions four cases.

Skeletal deformities have not been recorded. I find few records of spinal curvature. Nor has spinal paralysis been reported except in a case of Burckhardt's; but in this case the disease was localized within the vertebræ and the paraplegia was due to a cancer nodule within the spinal dura. Bending and distortion of the bones, such as is seen in osteomalacia, I find mentioned in only a single case by Grunert, in which pathological fracture of the fourth rib occurred, and osteomalic

changes in the pelvic girdle were noticed six years after a breast amputation, but the only bones recorded as examined post mortem were the ribs.

Joint symptoms have not been reported.

The blood picture is said to be altered in bone cancer. This has been studied on thirteen cases by Kurjuweit, who believes that blood changes are early and frequent features. He found a myelocytosis most characteristic with nucleated red cells and poikilocytes. Similar observations have been made by Braun, Ehrlich, and Türk. This phenomenon has been explained by the suggestion that carcinoma of the bones is really a disease of the marrow, and that the changes in the bone cortex are the result of irritation.

So far as I have been able to determine, radiography of skeletal carcinoma has not been systematically studied. Dr. Cole, of New York, tells me that he recalls only one case, that of a woman, the patient of Dr. W. P. Healy, in which spontaneous fracture of the femur occurred, just above the site of a similar fracture a year previous and three years after the onset of a carcinoma of the breast. The radiograph (Fig. 3), kindly furnished me by Dr. Cole, shows honeycombing of the shaft in the region of the fracture, extending into the old callus.

Dr. Caldwell, of New York, informs me that he has not seen a case, unless it was in an elderly physician where the diagnosis was obscure. The radiograph kindly shown me by Dr. Caldwell exhibited a slight enlargement of the shaft of the humerus dotted with irregular areas of softening, similar areas in the ribs, and a single large spot in the acromion process of the scapula.

Dr. Pfahler of Philadelphia writes me that he has seen three or four cases following breast cancer. He says that there is usually a marked absorption of lime salts, that the areas are sharply defined as compared with syphilis, osteomyelitis or tuberculosis, and the outlines are more irregular than bone cysts. He adds that there is no marked periostitis.

Dr. Eastmond, of Brooklyn, in a personal communication states that he has studied three cases. He says that the

radiographic findings are essentially the same as those seen in any acute infection—a destruction of bone followed by the piling up of detritus. In the vertebræ, he says, the condition is similar to that seen in Pott's disease.

Rumpel, in his X-ray studies on tumors and inflammations of bones, published in 1908, includes three radiographs in three cases of bone cancer. In all his three cases distinct tumor was present (one of the fibula, one of the ulna, and one of the tibia). He states that the X-ray picture of carcinoma is not unlike that of central sarcoma.

The radiographs of the case I report (Figs. 1 and 2) show irregular areas of rarification throughout the shafts of both femora, in two ribs, and both fibulæ.

In the main, the lesions pictured in the bones by the X-ray correspond to the anatomic changes found by dissection, although, as Dr. Eastmond remarks, the number of cases examined has been too small to draw any definite conclusions. The cases which have been radiographed, undoubtedly represent exceptional cases. Naturally the cases most likely to come to the radiographer are those presenting tumor or fracture.

In six cases which I saw at post-mortem dissection at the Vienna Pathological Institute, there was no evidence of disease of the bones until their internal structure had been exposed.

In conclusion, it may be said that while this disease of bones presents a subject of academic interest, in that it has received little clinical consideration and is more common than generally believed, it also has points of practical significance, although no hope of cure can be expected in a malignant disease involving several bones, notwithstanding the fact that books on surgery of recent publication advise radical operation. In Cone's case a leg was amputated for a tumor of the tibia, in which carcinomatous deposits were also found in the vertebræ, two ribs, and ilium at autopsy.

This disease is of clinical interest in connection with that common group of cases labelled myalgia, lumbago, and chronic rheumatism. The majority of Kaufmann's cases were classed as "rheumatics." It will be a service if we can emancipate

another group of these so-called rheumatics from useless drugging. More of these victims should be submitted to X-ray examination. Dr. Eastmond states that in all his three cases the radiographic diagnosis was made accidentally, in two the examination being to determine the cause of pain in the extremities.

This disease has considerable significance in connection with fractures, especially those resulting from slight injury. In Dr. Healy's case, the earlier of the two fractures occurring in the same femur followed a minor injury, at which time Dr. W. T. Bull stated that the fracture was the result of a disease of the bone. It is of further interest to note that natural repair in these pathological fractures does occur. In Healy's case solid union took place in the first fracture. In one of Grunert's cases, a fracture of the tibia was entirely healed in two months. In the case I report, union is complete in both femora with excessive callus formation.

Skeletal carcinoma sometimes offers the first evidence of a primary neoplasm in the breast, thyroid or prostate. Thus, in Grunert's case, just mentioned, a tumor of the breast was not discovered till some time after the spontaneous fracture of the tibia. In another of his cases, pain in the bones, a small tumor of the skull, and pathological fracture of humerus and femur preceded the finding of a cancer of the thyroid. In Bloodgood's case, excision of the breast followed the amputation for cancer of the humerus. Kaufmann, as a result of his study of 100 cases of carcinoma of the prostate, states, "That the finding of metastases in the bones and lymph-glands is frequently the first evidence of a prostatic tumor." This is of peculiar interest since he has shown that cancer generally occurs as a small nodule in the hypertrophied, normal, or atrophic prostate; that it rarely grows to any appreciable size; and that it usually kills through its metastases in the bones or internal organs. According to Young cancer is found in 25 per cent. of enlarged prostates, and it is said that 34 per cent. of men past fifty have prostatic enlargement, though in only six per cent. does it cause urinary obstruction.

The relation of latent carcinoma in the bones to so-called

cures after radical operations upon the breast is an interesting question. On this point one of Grunert's cases is suggestive. In this case pain in the back and limbs occurred six years, spontaneous fracture and death eight years, after an apparent operative cure for mammary cancer. Dr. Eastmond tells me that all his patients were women upon whom excision of the breast had been done three to five years previously without recurrence at the site of operation.

LITERATURE.

1. Braun (L.): Ueber osteoplastisches Carcinom der Prostata, zugleich ein Beitrag zur Genese der perniciösen Anämie. Weiner med. Wochensch., 1896, No. 13 and 14.
2. Bloodgood (J. C.): Review of Bone Tumors, in the Progressive Medicine Series.
3. Burckhardt (E.): Socin and Burckhardt's Die Verletzungen und Krankheiten der Prostata. Stuttgart, 1902.
4. Cone (S. M.): A Case of Carcinoma Metastasis in Bone from a Primary Tumor of the Prostate. Bulletin of the Johns Hopkins Hospital, May 1898, vol. ix.
5. von Frisch (A.): Frisch and Zuckerkandl's Handbuch der Urologie, 1905.
6. Goetsch (W.): Ueber den Einflus von Carcinommetastasen auf das Knochengewebe. Zeigler's Beiträge z. pathologische Anat., Band 39, 1906.
7. Grunert: Ueber pathologische Frankturen (Spontan-Fracturen). Deutsche Zeitschr. f. Chir., Band 76, 1905.
8. Kaufmann (E.): Die malignen Neubildungen der Prostata. Socin and Burckhardt's Die Verletzungen und Krankheiten der Prostata, 1902.
9. Kaufmann (E.): Lehrbuch der Speciellen Pathologischen Anatomie. Berlin 1901.
10. Kurjuweit (O.): Zur Diagnose von Knochenmarksmetastasen bei malignen Tumoren aus dem Blutbefund. Arch. f. klin. Med., 1903. Band lxxii.
11. Lenzinger: Die Knochenmetastasen bei Krebs. Ing.-Diss., Zurich, 1886.
12. Ritchie (J.): Carcinoma Metatases. Edin. Med. Journ., xlii, 1892.
13. Rumpel (O.): Geschwulste und Entzundliche Erkrankungen der Knochen im Roentgenbild. Hamburg, 1908.
14. Sasse (F.): Ostitis Carcinomatose bei Carcinom der Prostata. Arch. f. klin. Chir., 1894, Band xlviii.
15. von Recklinghausen (F.): Die fibröse und deformirende Ostitis der Osteomalacie und die osteoplastischen Carcinome in ihren gegenseitegen Beziehungen. Festsch. zu Virchon 71 Geburtstag. Berlin, 1891.

A TOURNIQUET FOR THE CONTROL OF HEMORRHAGE FROM THE SCALP DURING OSTEOPLASTIC RESECTION OF THE SKULL.*

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THE scalp receives a larger supply of blood than any other portion of the skin of equal area. The arrangement of its vessels is peculiar. Running in the dense connective tissue layer, which, by its closely disposed perpendicular and oblique fibres, binds the skin firmly to the aponeurosis of the external oblique, they are unable to contract and retract when cut as do vessels under other conditions. These facts explain the free and persistent hemorrhage from wounds of the scalp. Under ordinary circumstances the difficulty is overcome by the application of sutures or pressure, or both.

The introduction of osteoplastic resection of the skull has given a fresh importance to the problem of bleeding from the scalp vessels. The incision, several inches in length, in many cases, and the operation being necessarily prolonged frequently, there is a loss of blood which is always serious, and may even be the cause of a fatal termination. In common with others, I presume, who have been engaged in this line of work, I have endeavored to find a satisfactory method of preventing this apparently unnecessary hemorrhage. The use of the elastic band never appealed to me. On account of the oval shape of the head, in order to be at all effective it must be applied so firmly that excessive pressure is made on the forehead and occiput, while in the temporal region, unless reinforced by inserting a pad under the band, it is insufficient to control the vessels. The pressure forceps of Howzell and

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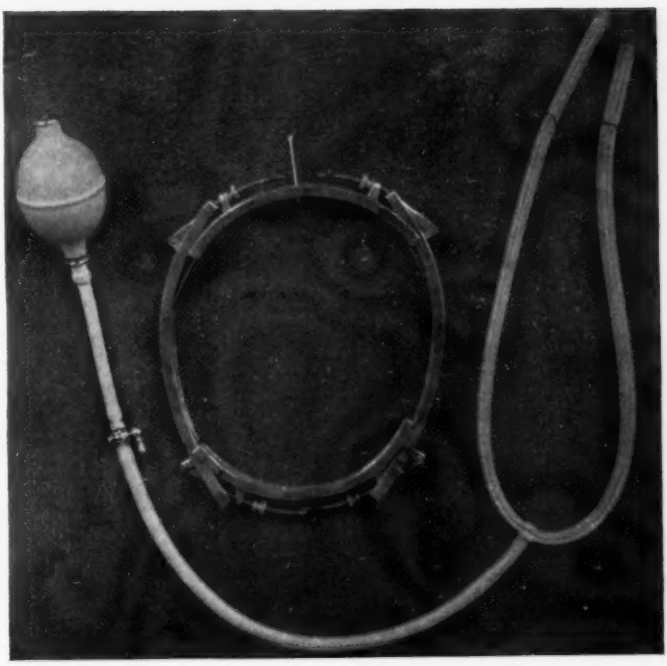
FIG. 1.

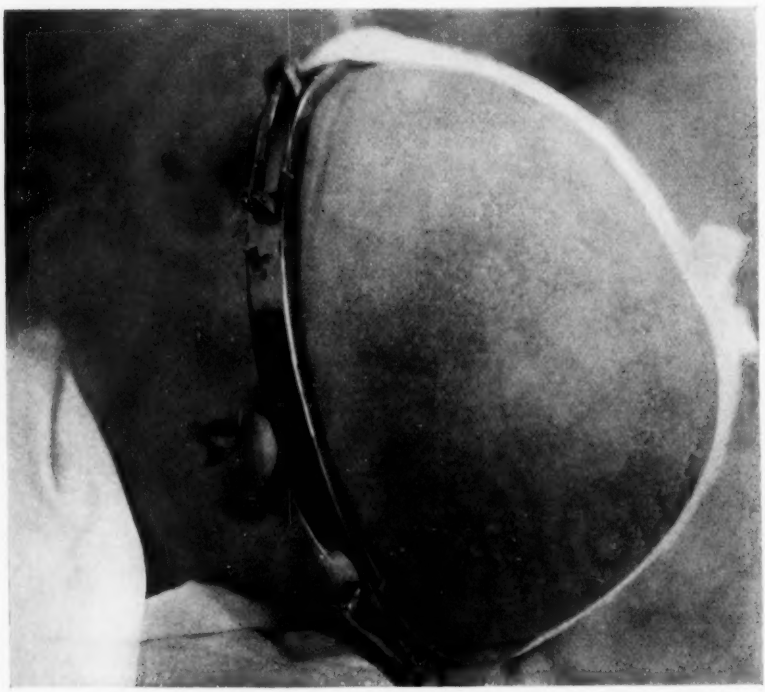


Showing the segmented metal head-band, inflatable rubber tube, inflating tube, 3-way cock, rubber inflating bulb (Wood).

FIG. 2.

Tourniquet applied. The bulb is placed on the chest for illustration. In use it is allowed to drop toward the floor.

FIG. 3.



Side view.

others are so much in the way of the steps that follow the scalp incision that they are but little used. I have not employed the interlocking mass suture of Heidenhain, nor the modification of Kredel, as neither seemed to me practical.

On account of the shape of the head, the irregularity of the outline of the fronto-occipital circumference of the skull, and especially in view of the receding temporal fossa, where pressure is especially important, as the base of the flap in almost all operations upon the cerebrum is at this point, an inflatable rubber tube appeared desirable. In order that the pressure might be uniform and not unduly localized to the forehead and occiput, the need of some form of external frame to form a resistance against which the tube could act was evident. Without the latter, the effect of the tube would practically be the same as the elastic tourniquet. With these thoughts in mind, I had constructed an inflatable rubber tube long enough to encircle the head and an adjustable metal band, into which the tube fits. At the centre of the inflatable tube is joined a piece of ordinary tubing through which the former may be distended. The band consists of four segments,—a frontal, an occipital and a right and left temporal—which, when joined together, have the outline of the fronto-occipital circumference of the skull, and, being adjustable, may be adapted to any head of ordinary size or shape. The temporal segments are 1.4 cm. ($^{9}/_{16}$ in.) and the frontal and occipital portions 1.6 cm. (about $\frac{5}{8}$ in.) in width; all are 0.6 cm. ($\frac{1}{4}$ in.) in thickness. The band is held together by hinged arms, upon which a thread has been cut, attached to the ends of the temporal sections and passing through eyes set on the ends of the frontal and occipital sections respectively. The size of the band is regulated by thumb-screws operating on the arms. The joints have been so constructed that the inflatable tube is fully supported in every possible adjustment of the band. At the middle of the frontal segment a hole is provided through which the inflating tube projects. Any other position may be chosen, but this seemed the most available. Inflation is secured by means of an atomizer bulb, joined to the inflating tube by

a three-way cock, by means of which the air is retained in the tourniquet or is instantly released. Instead of this cock, the air may be controlled by compressing the inflating tube by hæmostatic forceps. Both the tube and the metal band may be boiled, or immersed in the usual antiseptic solutions. In either case, it is desirable to clamp the open end of the tube in order to prevent water from entering.

To apply the tourniquet, (1) the head band is adjusted somewhat larger than the head; (2) the rubber tube is placed inside of the band; (3) a piece of gauze bandage, two inches wide, doubled upon itself so as to be one inch wide and a little more than three feet long, is carried across the head, the middle being about at the vertex, so placed as not to encroach upon the operative field; (4) the tourniquet is slipped on the head so that the frontal portion is in contact with the eyebrows and the posterior part just below the occipital protuberance; (5) the ends of the bandage are brought together and tied. The thumb-screws are then adjusted to make the metal band set closely to the head, but without causing pressure.

Directions as to those details connected with the application of the apparatus that must conform to a most rigid antiseptic technic have been purposely omitted, as each operator can best adapt these in accordance with his particular methods.

The tube is inflated by a rubber hand bulb which is advantageously operated by the anæsthetizer, although another assistant may attend to this detail. The exact amount of pressure necessary may be ascertained by placing a finger upon one of the branches of the temporal artery above the tourniquet. When the pulsation has ceased the proper tension has been obtained. Or it may be estimated with sufficient accuracy by noting the resistance to compression of the bulb. As the tube is inflated by the ordinary atomizer bulb, operated by hand, there is no danger of applying injurious pressure at any point. On the other hand, as the tube is equally supported throughout its circumference, the compression is uniform at every point, however irregular the outline of the skull.

In common with all other tourniquets that I have used, unless supported it has a tendency to roll over the eyebrows during the operative manipulations and rest on the eyes. This requires a re-adjustment, which is both time consuming and annoying. Hence the necessity of counteracting this tendency by a bandage carried across the head before the tourniquet is applied, as already described.

I have used an apparatus of this sort for several years, and in the present form for the past three years. When the tourniquet has been adjusted as above described, I have been able to complete the osteoplastic exposure of the brain with whatever other details were required without the necessity of clamping a single scalp vessel. I allow the bulb to remain attached to the tube during the operation, and if any oozing from the scalp is observed, the anæsthetizer is requested to compress the bulb once or twice, which is always effective in arresting the flow.

An objection to the use of the tourniquet in cases with severe intracranial pressure has been raised by Archibald, apparently on theoretical grounds. He thinks it possible that in such cases this circular compression might increase the cerebral pressure by preventing the escape of blood through the emissary veins to the scalp, thence to the jugulars, which it is believed may take place. I have employed this tourniquet in two cases showing extreme cerebral tension within a few months with entire satisfaction in every respect. However, this tourniquet is so constructed that the pressure is instantly released by turning the cock, and is almost as quickly restored by compressing the bulb. The inflation and deflation are not only accomplished quickly but also without the least disturbance of the patient's head, the surrounding aseptic sheets or even the progress of the operation. It is thus a very simple matter to interrupt the pressure from time to time, if the operator desires to do so.

My attention has been called recently to the fact that Cushing described in 1904 his pneumatic tourniquet. While I was not familiar with his apparatus, I desire to give him full credit

for priority. It may be noted, however, that this instrument is based upon a different principle.

The tourniquet above described is the only one with which I am familiar that provides a means of making uniform pressure throughout the entire circumference of the head, adapting itself to all irregularities of surface, and that does not make undue or injurious pressure at any point. As a means of controlling hemorrhage from the scalp incision during prolonged operations, I believe it will be found superior to any form of circular compression clamp or scalp suture so far devised.

THE PATHOLOGY OF THE GALL-BLADDER AND SOME ASSOCIATED LESIONS.

A STUDY OF SPECIMENS FROM 365 CHOLECYSTECTOMIES.*

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A STUDY of the diseases of the gall-bladder without consideration of the closely associated organs, and without reviewing and compiling the facts regarding the embryology, anatomy and physiology of these organs, would be not only incomplete but apt to lead us to narrow and perhaps fallacious conceptions. In text-books, journals and lectures there is too great a tendency toward an anatomical arrangement of facts—a type of presentation which is incomplete, in that the anatomical boundaries of an organ are of no greater importance than are its functional boundaries and dependencies. Since our partial appreciation of more intimate activities of cells, and the dependency and influence of cells upon other cells, we must add to a study of every organ a consideration of its relation to other organs. Perhaps the oldest recognizable and yet unsolved dependency of organs upon other organs, or cells upon other cells, is seen in the influence upon the mammary glands by stimuli which start in the pelvis during pregnancy. There are organs, however, which are more closely related anatomically and embryologically than these, but which have not been studied correlatively. The close embryological relation of the stomach, duodenum, bile passages, liver and pancreas has not been considered sufficiently from a biological standpoint. The occurrence of such a relationship may be readily seen in the fact that phylogenetically and ontogenetically these

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have evolved from a single tube, the primitive alimentary canal, lined by columnar or cuboidal epithelium, which is present in the amphioxis and in the human embryo. In the simplest forms of animal life possessing an alimentary canal there is no anatomical differentiation into stomach and small and large intestine. The food-stuffs received into such a canal are broken down and assimilated through activities of the lining epithelium. In more highly specialized organisms differentiation into stomach and intestine occurs. There appears at an early stage of this evolution the original liver as a diverticulum of the alimentary tract. It develops from the duodenum; the cells multiply and become the parenchyma of the organ. The pedicle of this mass of cells retains its lumen, or develops a lumen to form the ductus communis. From this diverticulum arises another which becomes the cystic duct and gall-bladder. The pancreas and pancreatic ducts have a similar origin. It may be seen that the functional cells of the liver, gall-bladder, bile ducts, pancreas, pancreatic ducts and duodenum have a close, common ancestry, and are therefore biologically closely related.

One would naturally expect the life unit (that is, the cell) of multicellular organs, such as the liver and pancreas, to retain some of its original sensibilities and activities, although placed in a somewhat different environment. The same blood mechanism which bathes the tissues of the digestive tract in the simpler forms of life exists in the more specialized forms, as may be seen in the anatomical arrangement of the portal system which leads directly to the liver. At least one close physiological instance serves to show that the pancreas and possibly the liver react to stimuli from the duodenum through the blood, as has been shown by Dolinsky,[1] who discovered that acids brought into contact with the mucosa of the duodenum caused prompt secretion of the pancreatic juice. Popielsky,[2] Bayliss and Starling[3] demonstrated this action after severance of the nerves which connected this organ with the pancreas, and therefore concluded that the cells of the duodenum when in contact with a 0.4 per cent. hydrochloric acid

solution gave off something to the blood which acted on the pancreatic cells and possibly on the liver cells.

During specialization and rearrangement of cells of the early upper abdominal alimentary canal nature has twisted the regular nerve supply of the simplest forms until careful study now demonstrates that although the organs are distinct in the higher organisms they are still connected by the same sympathetic, motor and sensory nervous systems. Fibres of the splanchnic nerve reach the walls of the stomach pylorus, bile ducts, gall-bladder, liver and pancreas through the coeliac plexus. The vagus contains branches to and from these organs. Physiologically, a part of this nerve connection has been demonstrated by Pawlow,[4] who showed in animals that gastric secretion was increased by stimulation of the vagus. Hornburg [5] found the same thing true in the human being. Experimental stimulation of the splanchnic nerve diminishes the flow of bile, and section of the same increases the flow. Relationship between these organs may be supplemented and strengthened from the physiological standpoint by a study of the character and distribution of portal blood. In the most simply organized animals products of the activities of the lining cells of the digestive tract are taken up by the underlying blood capillaries and passed into the general system, and in the most highly developed vertebrates this is also true, the products, however, first passing through the liver, which was primarily a part of the digestive tract, thus the liver cells are brought as intimately into contact with and are bathed by the same fluids as the cells out of which the liver grew in the simpler forms of organization. The change in the amount of liver secretion through the influence of absorbed products from the duodenum and through stimulation of the splanchnic nerve has lead Howell [6] to say that we may believe that the quantity of bile secreted varies with the amount and composition of the blood flowing through the liver.

It may be said, therefore, before taking up pathological conditions which arise in the gall-bladder, that the aforesaid organs are embryologically, anatomically, physiologically, and

I shall endeavor to show, pathologically, to be considered a gastro-duodeno-hepatico-pancreatic physiological system, and not functionally separated by arbitrary anatomical boundaries. The questions arising which may have some light thrown upon them by this study are:

First, what are the pathological conditions which arise in the gall-bladder?

Second, what pathological conditions are frequently associated with lesions in the gall-bladder?

Third, what evidence is there for common disturbance in the activity of the duodenum, stomach, liver, and bile passages?

Fourth, what is the relationship between the condition of the stomach and conditions in the duodenum and the function of the liver, gall-bladder and pancreas?

Fifth, is there any relationship between the frequency of pathological conditions of the appendix and disturbances in the stomach, duodenum, liver, gall-bladder and pancreas?

MATERIAL.

The material for study in this paper has been furnished by 365 out of 657 cholecystectomies performed by Drs. W. J. and C. H. Mayo, and studies made by the writer at operation in cases in which cholecystostomy for drainage or stones was done.

As soon as the specimens were removed they were examined grossly and microscopically. They were classified into eight groups, which have been verified by examination of fixed specimens just previous to the preparation of this paper.

The normal gall-bladder (Figs. 1 and 2) presents itself at exploration as a bluish, thin-walled receptacle, the contents of which may be gradually expressed. It may be deeply imbedded in the liver substance, it may be double or absent. It varies in size within wide limits.

In classifying the pathological conditions into groups one must bear in mind that one specimen may present the characteristics of the several " types " described. This fact necessitates speaking of specimens as uncomplicated or complicated by

other grades of lesions. The term uncomplicated simply means that grossly the specimen presented practically only one picture.

Group I: Cholecystitis, Catarrhalis Acuta (Figs. 3 and 4). There were 65 uncomplicated cases and 9 cases complicated by other stages. Forty-five (69 per cent.) of the uncomplicated cases were associated with gall-stones. In this group may be placed the gall-bladders which retain their general characteristics regarding size and color, both inside and out; in other words, "normal," with the exception that the villi, congested and infiltrated with lymphocytes, are more prominent than normal. The infiltration may extend into the other layers of the wall. The condition occurs with or without stones. My attention was first drawn to this early condition by examination of a resected gall-bladder, which contained stones, but showed grossly no apparent change. Upon microscopical examination, however, the mucosa was infiltrated with lymphocytes and leucocytes. The diagnosis was sometimes made at operation by the thickened viscid bile, which seems to indicate hyperactivity of the glands of the mucosa and partial obstruction to the natural drainage. Other specimens in which no stones were found presented this same condition, and clinically gave a picture of cholecystitis. The stones which occurred in these cases were usually small, and may have been passed through the ducts in the cases in which none were found, or the condition may be the forerunner of stones. This early reaction of the mucosa was seen again in association with further changes, which constitute the second group.

Group II: Cholecystitis, Catarrhalis Chronica (Figs. 5 to 14).—Constituting this group were 39 uncomplicated cases and 39 cases associated with other types of inflammatory reaction, 30 (76 per cent.) of the uncomplicated cases contained stones. These specimens vary from Group I only in degree, and one portion of the gall-bladder may belong to the first group and another portion to this group. The principal change grossly consists in an "erosion" of the apices of the villi. These desquamated apices present themselves as yellow

specks scattered over the mucosa (see Plate I.) Otherwise the mucosa may appear normal or congested. This condition we have described as the "strawberry" gall-bladder, on account of the resemblance of the yellow specks to strawberry seeds. These have also been mistaken for fine stones. Microscopically one sees that the epithelium is lost and replaced by scar tissue. Clinically there is nothing to distinguish this group from Group I. It is found with or without stones.

Group III: Cholecystitis, Catarrhalis Papillomatosa (Figs. 15 to 17).—In this group there was only one specimen. One of the villi was enlarged and appeared as a papilloma. The condition was associated with stones and an acute catarrhal reaction in the mucosa. The papilloma was 2 mm. long and about 1 mm. in diameter (Fig. 15, *a*). The cells of the epithelium covering the villi and papilloma were regular in size and shape and possessed nuclei showing no irregularities.

Group IV: Cholecystitis Papillomatosa Malignum.—Like papillomata in other portions of the body these often undergo an irregular or perverted hyperplasia, which manifests itself in marked reduplication of the rows of epithelial cells. Upon high power examination of the epithelial cells the chromatin granules are irregularly distributed, the nuclei are irregular in shape and size. These cells may or may not dip below the basement membrane. Such cases have been found during exploration, at which time portions of the gall-bladder were taken for examination. This type does not occur in this series because the cases seen were studied at exploration of inoperable cases.

Group V: Cholecystitis Catarrhalis Carcinomatosa (Figs. 18 to 25).—There were three cases of cholecystitis catarrhalis chronica which were complicated by carcinoma. The hypertrophy in the least advanced portions of the changed mucosa appears as knob-like outgrowths covered by epithelium which is in a stage of hyperplasia, which differs apparently from simple hyperplasia morphologically in that the nuclei are large, irregular in shape and size and have irregularly distributed

PLATE I.

Cholecystitis catarrhalis chronica. A color photograph showing the fresh appearance of the "strawberry" gall-bladder. (Case 32361.)

FIG. 1.

Gross specimen of a normal gall-bladder, held up to the light to show the thinness and translucency of the wall. (Case 25130.)

FIG. 2.

Section through the wall, showing the shape and regularity of the mucosa. (Case 25130.)

FIG. 3.

Cholecystitis catarrhalis acuta, in which the translucency has disappeared on account of the congestion and swelling of the mucosa. (Case 23219.)

FIG. 4.

Cholecystitis catarrhalis acuta. A section showing the hyperplasia of the epithelium and infiltration of the villi. (Case 23219.)

FIG. 5.

Cholecystitis catarrhalis chronica. The apices of the villi are eroded, leaving points of white or bile-stained connective tissue which cause the "strawberry" appearance against the velvety background. (Case 24225.)

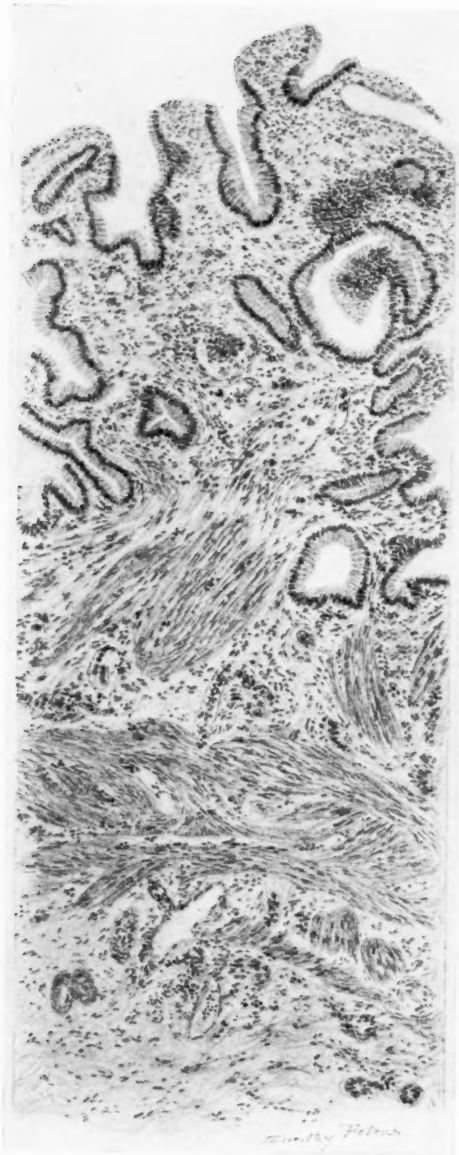
FIG. 6.

Cholecystitis catarrhalis chronica. (Case 17852.)

FIG. 7.

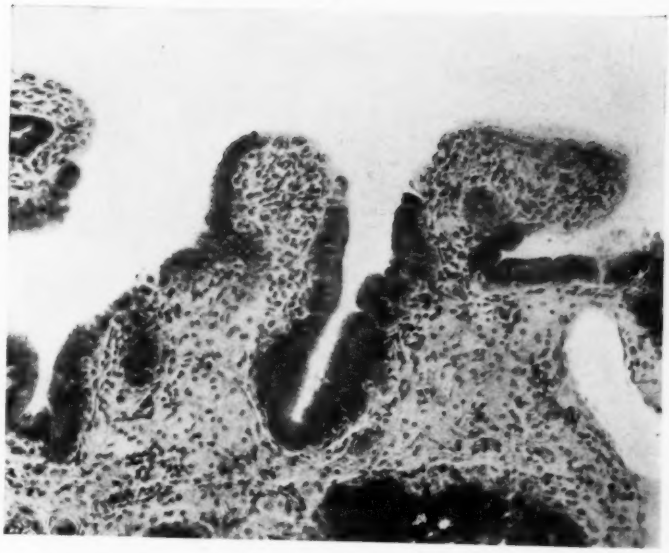
Cholecystitis catarrhalis chronica. (Case 21280.)

FIG. 8.



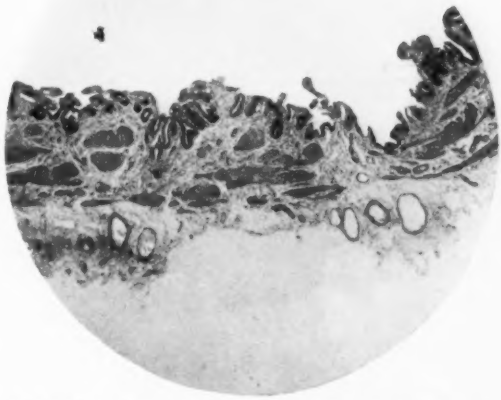
Cholecystitis catarrhalis chronica. Section through the thickened wall and desquamated apices. (Case 24225.)

FIG. 9.



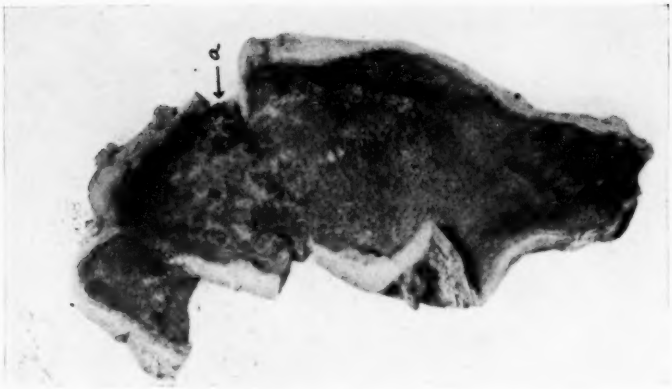
Cholecystitis catarrhalis chronica. (Microphotograph of Case 24225)

FIG. 10.



Microphotograph showing the distortion and irregularity of the mucosa. (Case 24225.)

FIG. 11.



Cholecystitis purulenta necrotica. (*a*) Abscesses. (Case 19698.)

FIG. 12.

Section through an abscess in the mucosa. (Case 19698.)

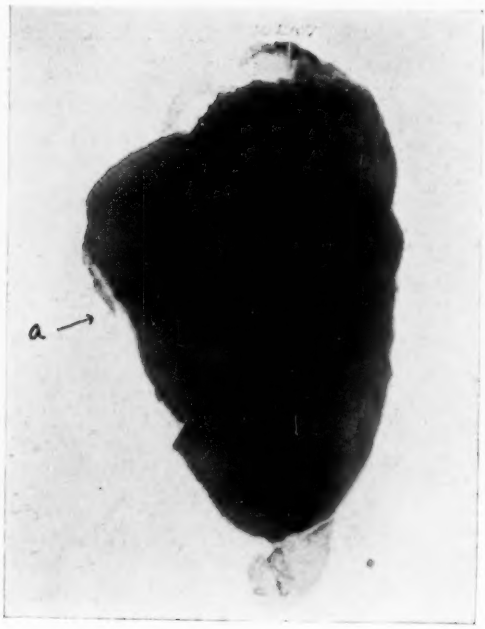
FIG. 13

Cholecystitis catarrhalis acuta. Section showing the infiltration of the mucosa and proliferation in a lymph follicle. (Case 20601.)

FIG. 14.

Microphotograph. The germ centre (Fig. 13). (Case 20601.)

FIG. 15.

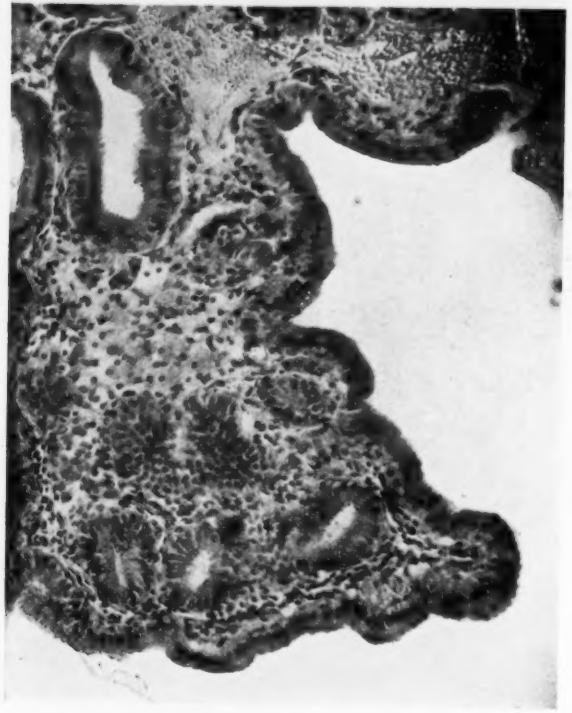


Cholecystitis catarrhalis acuta. Showing a papilloma (*a*). (Case 30267.)

FIG. 16.

Microphotograph of a section through the papilloma (Fig. 15). (Case 30267.)

Fig. 17.

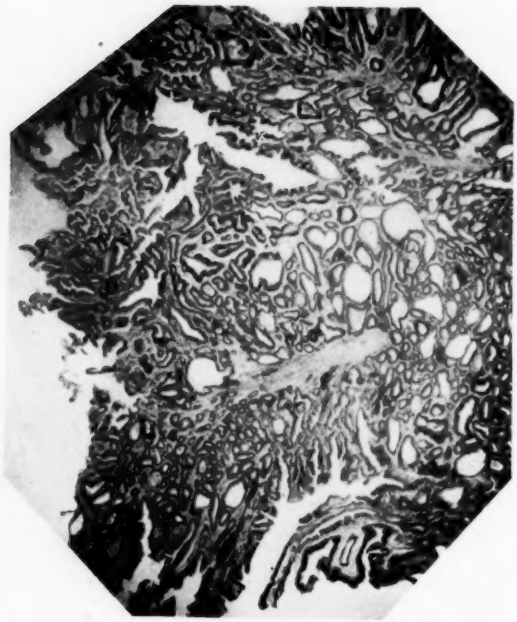


Microphotograph through Fig. 16 *a*. (Case 30267.)

Fig. 18.

Cholecystitis catarrhalis carcinomatosum. (Case 30188.)

FIG. 19



Microphotograph through the pedicle of portion *b*, Fig. 18. (Case 30188.)

FIG. 20.

High-power microphotograph of Fig. 19. (Case 30188.)

Fig. 21*a*

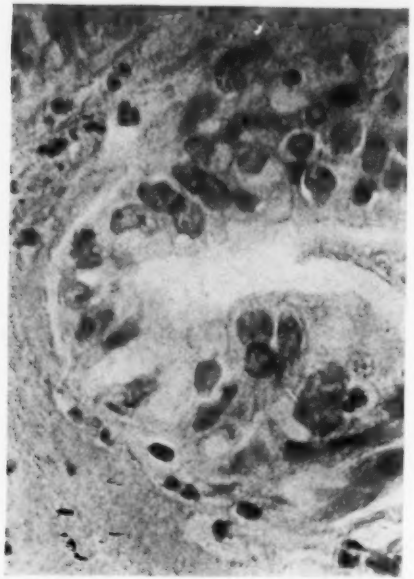
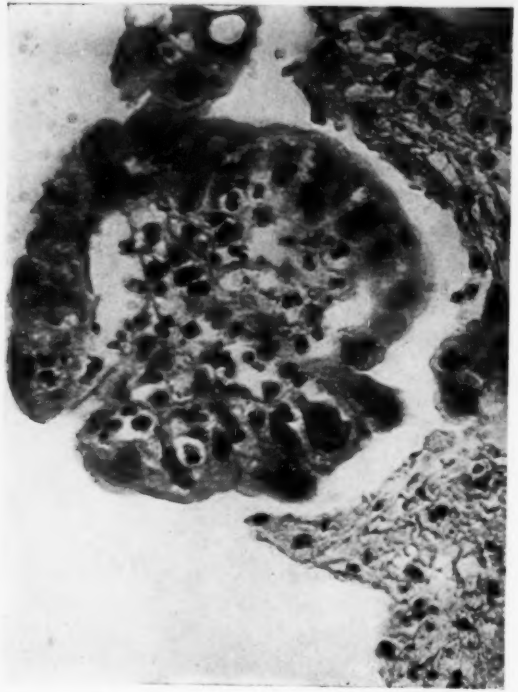


Fig. 21*b*.

Fig. 21*c*.

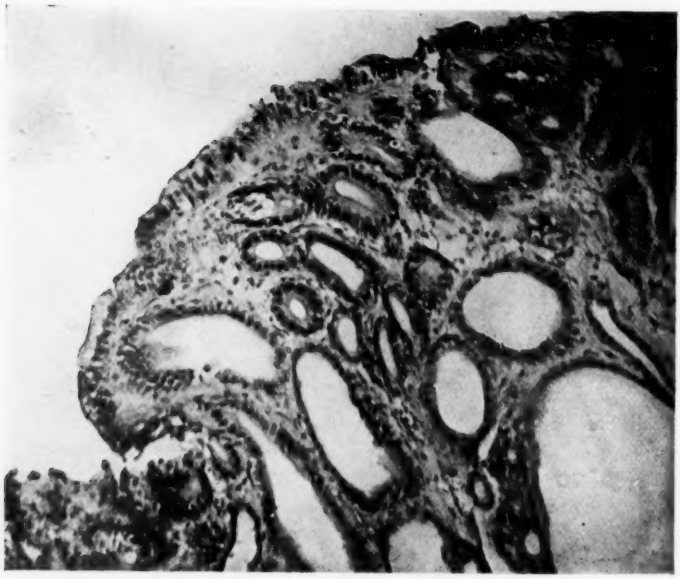


Microphotographs showing the irregularity of the cells in portion *b*, Fig. 18. (Case 30188.)

FIG. 22.

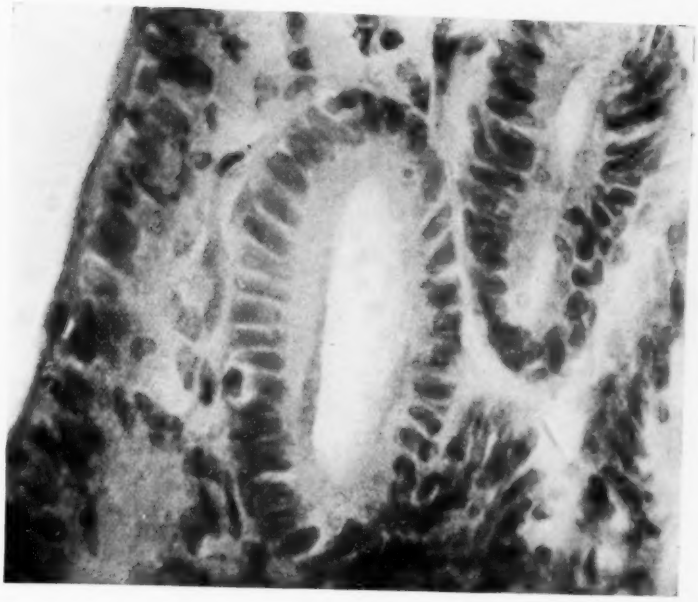
Microphotograph through portion *a*, Fig. 18. (Case 30188.)

FIG. 23.



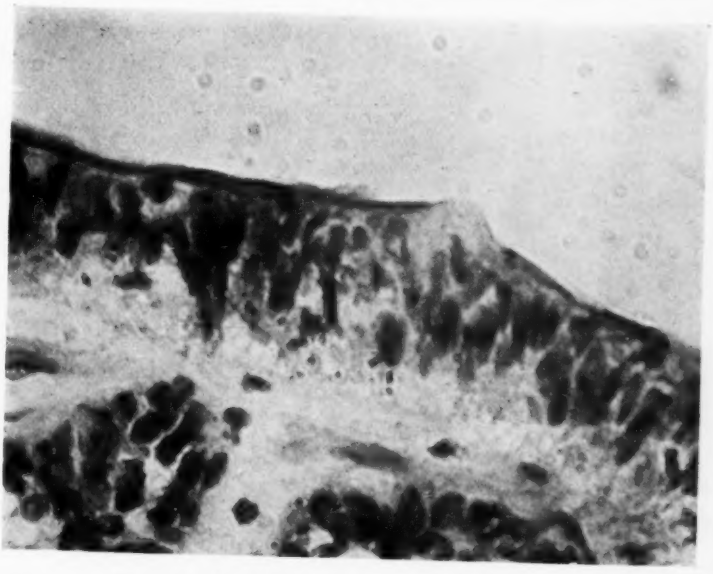
Microphotograph through portion *a*, Fig. 22. (Case 30188.)

FIG. 24.



Microphotograph showing the regularity and irregularity of the cells in Fig. 22. (Case 30188.)

FIG. 25.



Microphotograph of the lining epithelium. (Case 30188.)

FIG. 26.

Cholecystitis chronica. (Case 25208.)

FIG. 27.

Cholecystitis chronica, with a stone in the cystic duct. (Case 25504.)

FIG. 28.

a

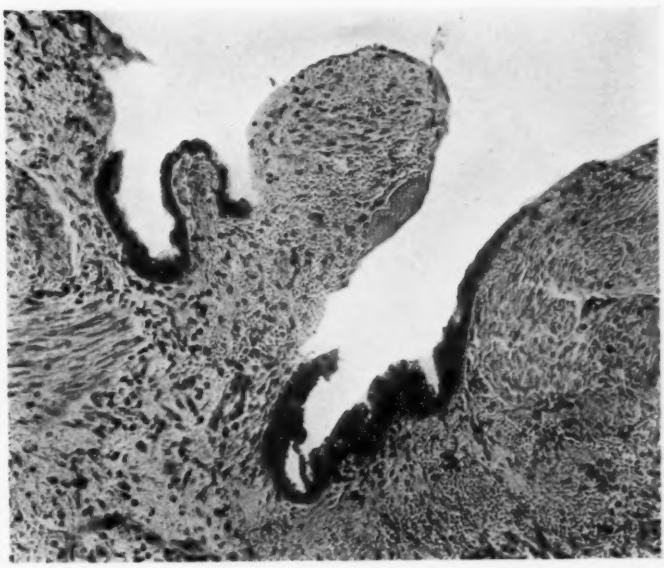
b

Cholecystitis chronica with almost complete destruction of the mucosa. *a*, Patches of intact mucosa, *b*, Scar tissue ridges. (Case 18407.)

FIG. 29.

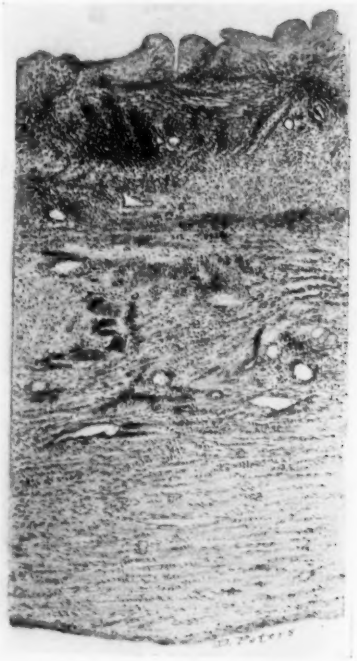
Section through the incompletely destroyed mucosa. (Case 18407.)

FIG. 30.



Microphotograph of Fig. 29.

FIG. 31.



Section through the wall, showing the complete loss of mucosa. (Case 18407.)

FIG. 32.

Cholecystitis chronica. (Case 26870.)

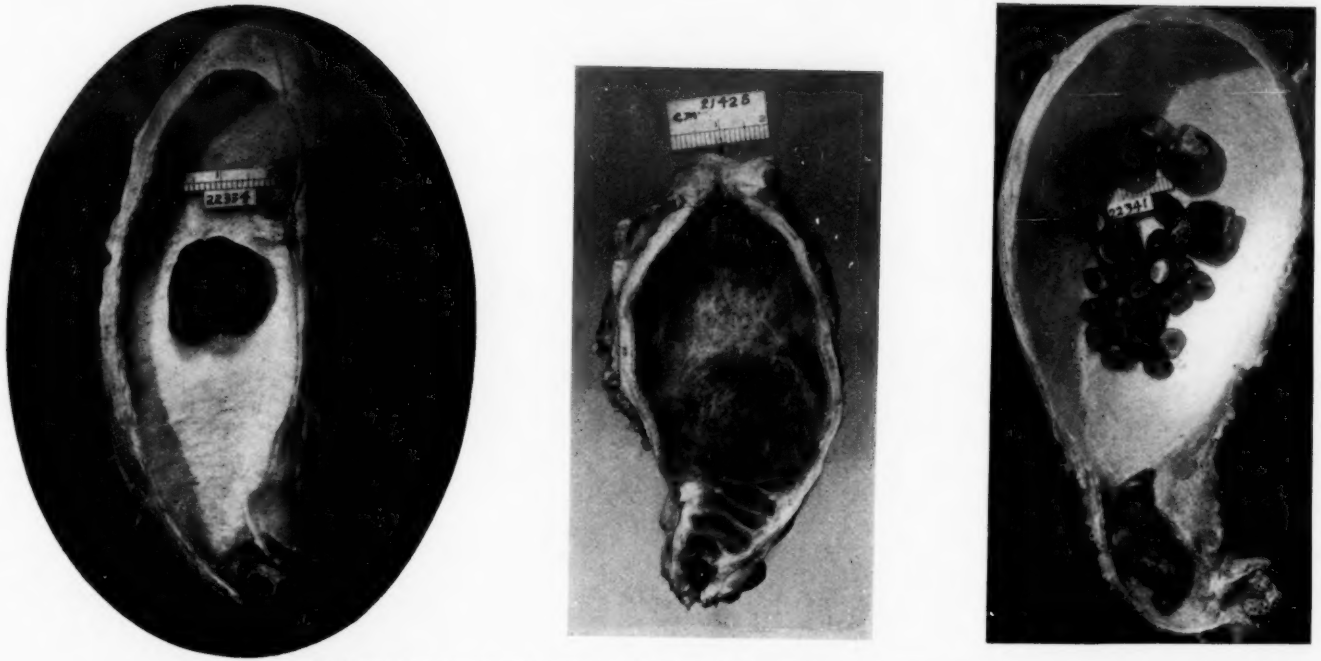
FIG. 33.

Section through the wall. (Case 26870.)

FIG. 34.

Cholecystitis chronica cystica with a stone in the cystic duct. (Cases 27024, 28912, 23428.)

FIG. 35.



Cholecystitis chronica with a stone in the cystic duct. (Cases 22334, 21425, 22341.)

FIG. 36.

Cholecystitis chronica with stones imbedded in the wall, which gives the specimens the name "Honeycomb gall-bladder." (Cases 28979, 25546, 24248.)

FIG. 37.

Various sizes and shapes of stones found n the series. *a*, A stone which caused intestinal obstruction by ulceration through the gall-bladder wall into the intestine.

FIG. 38.

Ulcer of the duodenum at the papilla of Vater. *a*, The common duct penetrating the base of the ulcer. (Case 31049.)

FIG. 39.

Ulcer of the duodenum associated with cholecystitis catarrhalis chronica and stones. *a*. Papilla of Vater. (Case 31501.)

chromatin (Fig. 21). There are areas however which contain glands, the nuclei of which are regular and indistinguishable from normal or hyperplastic glands (Fig. 24). The more extensive outgrowths (Fig. 18, *b*) arise from the mucosa and possess a base not unlike that seen in the papilloma (Fig. 16). The body of the growth is composed of masses of epithelium (Figs. 19, 20) which, upon high power examination, presents extensive irregularities in the size, shape and distribution of the chromatin granules. Differentiation between this group and Group IV, cholecystitis papillomatosa malignum, must be made with reserve because it is possible that the one is but a stage of the other. No specimens in my series presented sufficient evidence for grouping both conditions under one heading. They present papillomatous outgrowths, differing only in shape. Those under Group VI were knobs, while those in Group IV were filiform and less massive. Earlier stages of carcinoma of the gall-bladder must be found and studied before the life history of such perversions of the epithelium can be accurately pictured.

Group VI: Cholecystitis Chronica (Figs. 26 to 33).—There were 78 uncomplicated and 64 complicated cases; of the uncomplicated 73 (93 per cent.) were associated with stones. In this group is placed a condition, gradual stages of which may be seen in specimens of Group II. The continued desquamation of the apices of the villi is associated with proliferation of the connective tissue of the villi and submucosa. The surface, which is normally regular, contracts irregularly and leaves ridges of scar tissue. Upon microscopical examination the inner surface is seen to be void of epithelium and the mucosa has been replaced by scar tissue. The process is not always complete over the whole gall-bladder, as a result of which areas of the condition described in Groups I and II may be seen (Fig. 28). It may occur at operation with or without stones. It has been classified under the term cholecystitis chronica because the mucosa has almost completely disappeared and the process is a chronic one involving the other coats of the wall.

Group VII: Cholecystitis Chronica Cystica (Figs. 34, 36).—Seventy-six cases. A stone may become lodged in the cystic duct or in the valves of the neck of the gall-bladder and cause obstruction and distention of the organ. This results in thinning of the wall and destruction of the mucosa or flattening of the scar tissue ridges in the chronic cases. The stone usually is firmly imbedded between the valves and cannot be moved in either direction. Microscopically the wall is a thin layer of connective tissue in which traces of the nuclei of muscle cells may be seen sometimes. Such a gall-bladder attains great size, and is usually the type which presents itself as a large palpable tumor.

Group VIII: Cholecystitis Purulenta Necrotica (Figs. 11, 12).—Thirty-three cases. During any stage of inflammation obstruction to the cystic duct may be so great, or the pyogenetic infection so virulent that disturbance of the circulation or multiple abscesses in the gall-bladder may occur. The specimens are usually distended, dark blue or black, the contents pus or blood and usually not bile-stained.

Pericholecystitis Acuta and Chronica must be considered a sequel of any of the above mentioned degrees of inflammation. Even in the earliest degree of cholecystitis catarrhalis acuta the process may extend to the serosa through the lymphatics, and it is not infrequent to see adhesions, usually to the omentum and transverse colon in this stage.

RÉSUMÉ OF THE GROUPS.

It may be seen that the pathology of the gall-bladder reduces itself not to definite pathological lesions, but to stages in a pathological process, which consists of an infection of the mucosa of the gall-bladder, the common or cystic ducts. The elements of disturbance are mechanical and inflammatory. Disregarding the etiology of the condition and whether the infection ascends from the duodenum or descends from the liver, the fact remains that swelling of the mucosa in the ducts at any point in the presence of and aided by some infecting organism causes certain changes or reactions in the wall of

the gall-bladder. The reaction is not unlike inflammation in other parts of the body. To a mild obstruction or infection the first reaction is congestion of the mucosa with slight infiltration. Grossly, the mucosa does not differ perceptibly from the normal mucosa. At this stage the bile at exploration may be of great assistance in making the diagnosis: it may contain an increased amount of "mucin" which gives it greater cohesive quality. Adhesions to the gall-bladder do occur, even with this slight degree of reaction. Congestion and necrosis of the mucosa result in desquamation of the epithelium, thus leaving the tips of the villi bare. These become bile stained and appear as yellow specks, thereby causing the "strawberry" appearance. This condition is only a stage toward further destruction of the epithelium, flattening of the villi and increase in density, due to connective-tissue proliferation, until the velvety appearance of the inside of the gall-bladder disappears and is replaced by a gray, not infrequently, pigmented surface. Externally the wall is seen to be gray and dense. Microscopically, the degrees of the process may be verified.

An obstruction to the outflow of the contents of the organ by a stone in the duct plus a pyogenetic infection disturbs the circulation of the wall, causes pus formation and necrosis, which may bring about rupture of the wall and peritonitis, or drainage into neighboring organs. The fact that this complication may occur in gall-bladders in any of the above-mentioned stages results in different pictures of the conditions. The mucosa may be partially intact or completely destroyed. Blocking of the cystic duct alone does not always produce necrosis, at least specimens at operation are often seen in which there is complete obstruction, due to an impacted stone and which present themselves as large, distended, gray-colored, thin-walled cysts. The contents are almost always clear or slightly cloudy and free from bile pigment. The inner surface is usually smooth, or shows only traces of the scar tissue ridges described under cholecystitis chronica.

The relation between inflammation and carcinoma has been so constant in many parts of the body, especially demon-

strated in the stomach by Oettinger,[7] Hoche,[8] Graham,[9] Wilson and MacCarty,[10] MacCarty,[11] *et al.* who have shown that a very high percentage of stomach carcinomata occur in the walls of chronic ulcers, that one strongly suspects in the nine cases * of carcinoma of the gall-bladder in which the average duration of symptoms was nineteen and four-tenths years, that the malignant perversion did not exist over such a long period. This is especially reasonable when one considers that in 280 cases, which were not carcinoma and in which the duration was stated in the histories the average was only six and seven-tenths years.

The question to be asked after a survey of these figures is, can carcinoma exist nineteen and four-tenths years and give symptoms, or were the symptoms inflammatory during this period?

CONTENTS OF THE GALL-BLADDER.

From a diagnostic stand-point during operation the fluid contents of the gall-bladder may give much information to the operator.

The bile, which normally is a thin amber-colored fluid containing a small amount of mucus, reveals grossly not infrequently the stages of infection.

An excess of mucus which causes it to be "stringy" is a result of an abnormal activity of the glands of the mucosa, and is almost if not always invariably the result of infection or irritation, occurring with partial obstruction to the natural drainage. Cholesterin crystals which may sometimes be seen grossly in bile which contains no stones, may be taken as indicative of stagnation. Very dark, dirty bile is the result of acute or chronic congestion.

In cases in which there is complete acute obstruction the bile may be bloody or purulent.

The more chronic complete obstructive cases almost invariably contain thin watery or milky fluid.

* There were 14 specimens of carcinoma examined, 3 were complete gall-bladders and 11 were portions removed for fresh diagnosis in inoperable cases. In only 9 of these cases was the duration stated in the histories.

Stones (Fig. 37).—Two hundred and fifty-two, or 67 per cent. of the 365 cases, were associated with gall-stones, which varied in shape, size and composition, all of which properties bore no apparent relation to the character of the lesion in the gall-bladder.

Interesting, however, is the fact that the percentage of specimens in each group which were uncomplicated by other stages of inflammation and which were associated with stones increased proportionately with the extent of the inflammatory reaction in the gall-bladder, thus 69 per cent. of the specimens which were in an acute catarrhal condition contained gall-stones at operation, although in such cases the possibility of the stones having been passed must be considered.

Of the chronic catarrhal gall-bladders 76 per cent. were associated with stones.

In the more advanced cases of chronic inflammation, in the cases in which practically all of the mucosa was destroyed, the percentage was 93.

From these figures it would seem that the occurrence of gall-stones bore a marked relation to the extent of the lesion and that the early acute catarrhal conditions do not necessarily occur associated with stones.

CLINICAL SUMMARY OF CASES.

The histories of these cases were taken by different members of the staff, and the personal equation must be taken into consideration in reviewing the clinical figures.

Age.—The youngest patient in this series was a girl (Case 21,610) sixteen years of age, who had suffered attacks of pain under the right costal margin for one and one-half years. This was associated with jaundice and marked tenderness over the right hypochondrium. The gall-bladder was œdematous, distended and contained a stone in the cystic duct. The mucosa was intact, excepting the apices of the villi, the epithelium of some of which was desquamated. The specimen was classed in the groups cholecystitis catarrhalis chronica, and cholecystitis chronica cystica. The eldest patient in the series was

a male (Case 25,217) aged seventy years who, twenty-five years before operation, had suffered attacks of epigastric pain which radiated to the back. At operation the gall-bladder was filled with stones, and the thickened wall was infiltrated by carcinoma. There was a stone in the cystic duct. This specimen may be grouped as cholecystitis catarrhalis carcinomatosa. Only 25 cases, or 6 per cent. in the series were under twenty-five years of age.

Sex.—Out of 365 specimens examined 298 or 81 per cent. were from females and 67 or 19 per cent. were from males, which emphasizes the already recognized predominance of the condition in females.

Onset of Symptoms.—It was interesting from a pathological and clinical stand-point to determine how many cases had symptoms in early life, that is, under twenty-five years of age. It was thought that there might be some relationship between appendicitis, which is perhaps more common in this period, and the production of inflammation in the gall-bladder, as was suggested by Ochsner,[12] who thought that the portal of entry for the infecting organism might be the appendix. In the whole series there were only 83 cases with symptoms which began at or under twenty-five years of age. This may be important in distinguishing between the effect of acute and chronic appendicitis on the condition,—that is to say, if the appendix plays a rôle in the etiology of cholecystitis it is strange that such a small number of the cases began under twenty-five years of age. This fact is significant when compared with the percentage of chronically affected appendices associated with cholecystitis. The question arises whether or not the appendix is the portal of entry for the organism, or whether or not stagnation in the stomach and disarrangement of the duodenum, liver and gall-bladder is brought about more commonly reflexly by chronic or subacute lesions in the appendix.

Pain.—Pain in cholecystitis seems to vary from mere discomfort to great severity. Practically all of the cases suffered from epigastric pain. Localized pain in the right hypo-

chondrium and under the costal margin occurred in the majority of cases. It was referred to the shoulder in 142 cases. The characteristics of the pain were described as colics, cramps or spasms. The attacks lasted from one to several hours, and were followed by tenderness in the epigastrium or right hypochondrium for two or three days.

Vomiting.—Two hundred and ten cases, or 57 per cent. of the series, gave a history of vomiting, although many others suffered from nausea.

Attacks.—Attacks of pain usually came on at intervals varying from twenty-four hours to months.

Jaundice.—One hundred and sixteen cases gave a history of jaundice, or were jaundiced at the time of examination. The presence of jaundice as a diagnostic sign is very important, but its absence is by no means against cholecystitis.

Constipation.—Ninety-one cases gave a history of chronic constipation.

Relation to Pregnancy.—Although many of the histories taken in married women did not record any special relation to pregnancy, there seemed to be a great many in whom the symptoms occurred during pregnancy, especially toward the end or shortly after.

Dyspepsia.—The question of a dyspepsia history, previous to the onset of definite gall-bladder symptoms, which occurred in 27 per cent. of the cases and might have occurred in more had this point been gone into more thoroughly in the taking of the history allows of speculation, about which at present we are unable to speak positively in a study of the cases presented.

Appendix History.—Thirteen per cent. of the histories contained definite reference to pain or soreness in the appendix area.

Fever and Chills.—While these were common in many cases it was not noted in the history often enough to be of any value, so far as a percentage was concerned.

Mortality.—Since the beginning of the hospital records there have been 657 cholecystectomies and 17 deaths, a percentage of two and a quarter.

ETIOLOGY.

The etiology of cholecystitis possesses many phases about which we know nothing definite. I shall only attempt to correlate some of the results of other investigations and my own observations in studying the material obtained at operation and postoperative postmortems.

The nature of the infection in the bile passages has been fairly well settled, although more extensive studies would doubtless throw considerably more light upon the subject.

It is fair at present, in view of the work already done on the bacteriology of the condition, to simply state that it must be considered that bacteria play an enormous rôle in the pathological lesions seen in the gall-bladder, liver and bile passages. How these bacteria reach the bile and gall-bladder is still a disputed point and may resolve itself into at least three methods, namely, indirectly through the liver from the portal circulation, as has been emphasized by Adami,[13] through the lymphatics of the intestine or directly by an ascending infection from the duodenum through the common duct. Evidence may be given in favor of all of these methods of infection, although this paper will only deal with conditions which may favor an ascending infection, or make clearer the causes of descending infections. The points worthy of mention are the occurrence of duodenal ulcer in association with cholecystitis, the occasional presence of a duodenal ulcer at the papilla of Vater, and the association of a high percentage of chronic appendicitis with cholecystitis. The first two of these may be seen in two cases in the series herewith presented.

The first case, No. 27,238, was a male aged sixty years, who was operated upon for cholecystitis seventeen months before the last operation. He was improved for five or six months, and again had epigastric pain, jaundice and vomiting. At the second operation, which was performed at St. Mary's Hospital, the gall-bladder was distended, the common duct dilated, and the head of the pancreas very hard. A note at operation stated that, if a third operation should be necessary it should be a cholecystenter-

ostomy. The patient died on the twelfth day after operation. The post-mortem examination revealed a marked cirrhosis of the liver, chronic cholecystitis, chronic pancreatitis, chronic congestion of the spleen, and a chronic ulcer of the duodenum at the papilla of Vater about 1 cm. in diameter. There was almost complete stenosis of the common duct in the base of the ulcer.

The second case, No. 31,049, was a male, aged fifty-eight, who, four years before examination, had attacks of severe epigastric pain which radiated to the back. Seven weeks before the last operation he had similar attacks accompanied by vomiting. At operation the gall-bladder was drained for cholecystitis with one stone, and a hard mass was felt at the end of the common duct, which was thought to be carcinoma of the head of the pancreas. On the fourth day after the operation the patient died from a hemorrhage into the bowel, associated with tarry stools and hæmatemesis. At autopsy a duodenal ulcer 2 cm. in diameter was found. The lumen of the common duct extended apparently unobstructed through the base of the ulcer (Fig. 38).

Both of these cases following upon the experimental work of Maffucci,[14] Charcot,[15] Gombault, Meyer [16] and Tsunoda [17] in which chronic changes in the liver (cirrhosis) were induced by artificial stenosis or partial stenosis of the common duct, must lead us to believe that changes at the papilla of Vater do either allow an infection to ascend the ducts, or through mechanical disturbances in the liver or gall-bladder cause a failure of these organs to prevent or resist infection of the bile from organisms in the portal or general circulation.

The third point, the high percentage of chronic lesions in the appendix in cholecystitis cases, in which both organs were removed at the same operation, is noteworthy from the fact that out of 59 cases in which both organs were removed, 69 per cent. presented definite gross and microscopical lesions, varying from chronic catarrhal conditions to complete obliteration and chronic periappendicitis. It is, however, well known that chronic changes in the appendix are found frequently in individuals who have never given symptoms which were recognized as appendicitis, and that all the chronic lesions which are found at operation have been found in a series of autopsies

made by the writer [18] upon individuals dying of other conditions. The frequency of chronic lesions in otherwise apparently normal individuals arouses the question whether or not 69 per cent. of normal individuals present chronic lesions, or whether this high percentage has any bearing on the lesions in the gall-bladder, in view of the fact that duodenal disturbances are occasionally associated with cholecystitis and knowing that gastric and possibly duodenal disturbances are associated with chronic appendicitis.

It has very often been observed clinically that many patients presenting themselves with marked discomfort and not infrequently sharp pain in the epigastrium, a sensation of fulness, bloating and hyperacidity following eating do not show any changes in the stomach, duodenum or gall-bladder recognizable at operation. An exploration of such cases usually reveals chronic appendicitis. After appendectomy the stomach symptoms disappear.

There is at least one inference to be drawn from a carefully studied series of such cases, and that is that the chronic inflammatory process, or the successive mild acute processes without marked localized symptoms reflexly affect the stomach. This clinical and surgical experience is further strengthened by experimental work. Talma and Clebs [19] produced erosions of the stomach mucosa by continued stimulation of the vagus nerve which causes contraction of the gastric musculature. Litthauer [20] found that artificially produced hyperacidity in the stomach plus trauma to the mucosa produced ulcers which immediately healed. If, however, he produced an anæmia of the part by ligation of the local vessels the ulceration or erosion remained unhealed. These experiments may have some bearing upon the work of Talma and Clebs, who produced an anæmia through contraction of the gastric, especially the pyloric, musculature by stimulating the vagus. They serve here only to bring to mind suggestions regarding known pathological lesions which occur in the stomach, notably the pylorus. The chain of clinical experience regarding chronic appendicitis, gastric and duodenal disturbances may be strengthened by the

experimental work of Roger,[21] who produced gastric hemorrhage by the injection of irritants into the cæcum and by Hedblom and Cannon,[22] who recently have demonstrated a most interesting phenomenon in the muscular rhythm of the stomach and intestines as a result of irritants in the colon. They say, " Not only is the gastric discharge much slower when the colon is irritated but the passage of the food through the small intestine is greatly retarded." This seems to give strength to the fact that there is at least some definite reflex effect upon the stomach and intestine produced by some abnormal conditions in the large intestine. These facts, although they deal largely with the stomach, may throw light upon the disturbances in the duodenum which is so intimately related to, and the functions of which are so closely associated with, the liver and bile passages. The latter are so closely connected with the stomach and duodenum embryologically, anatomically, physiologically and pathologically that disturbance in one might readily be expected to have disturbing influences upon the other.

The points which have come up during this study coupled with the two following cases have strongly aroused a suspicion that possibly the chronic changes in the appendix may reflexly cause disturbances in the stomach and duodenum, which in turn disturb the mechanism of secretion, storage and outflow of the bile, thereby producing conditions favorable for bacterial infection.

Case No. 31,621, a male, aged fifty-five years, who had stomach trouble associated with belching and distress after eating for eighteen years, during the last fifteen of which he had lost forty-five pounds in weight, presented himself for examination complaining of sour eructations, vomiting of bile, belching and diarrhœa. Vomiting always relieved the pain. A posterior gastro-enterostomy had been done elsewhere four years before. The stomach was enormously dilated, but without an ulcer. The patient died of acute dilatation of the stomach and exhaustion, and presented a chronic catarrhal cholecystitis, a strawberry gall-bladder, and an extensive peri-appendicitis chronica.

The second case, No. 31,501, a male, aged fifty-six, had his first attack of pain in the epigastrium three months before examination. It was referred to the right costal arch. A week later he had severe pain in the same region. This was accompanied by slight jaundice, no vomiting, but fever and constipation. He suffered from gas belching, bloating and headaches. At operation a large stone was removed from the neck of the gall-bladder, which it obstructed. The patient had a fatal hemorrhage into the bowel. At autopsy an ulcer of the duodenum was found (Fig. 39).

RÉSUMÉ.

1. The gall-bladder, liver, duodenum (pancreas and stomach are embryologically, anatomically, physiologically and pathologically closely related and should be considered a gastro-duodeno-hepatico-pancreatic physiological system.

2. The pathological lesions in the gall-bladder are not definite entities but are degrees in a process of reaction to irritants.

3. They may be divided into the following groups:

I. Cholecystitis catarrhalis acuta (Figs. 3 and 4).

II. Cholecystitis catarrhalis chronica (Figs. 5 to 15).

III. Cholecystitis catarrhalis papillomatosa (Figs. 15 to 17).

IV. Cholecystitis papillomatosa malignum.

V. Cholecystitis catarrhalis carcinomatosa (Figs. 18 to 25).

VI. Cholecystitis chronica (Figs. 26 to 33).

VII. Cholecystitis chronica cystica (Figs. 34 to 36).

VIII. Cholecystitis purulenta necrotica (Figs. 11 and 12).

4. Pericholecystitis acuta and chronica occur as sequels of the above-mentioned degrees in the process of reaction.

5. Pathological conditions in the duodenum are frequently associated with lesions in the gall-bladder and liver.

6. A high percentage of appendices showing chronic and subacute conditions is found associated with cholecystitis and may be an etiological factor in its production.

LITERATURE.

[1] Dolinsky: Quoted from Howell's Text-Book of Physiology.
[2] Popielsky: Quoted from Howell's Text-Book of Physiology.

[3] Bayliss and Starling: Journal of Physiology, 1902, xxviii, 325.
[4] Pawlow: Quoted from Howell's Text-Book of Physiology.
[5] Hornburg: Skandinavisches Archiv of Phys., 15, 1904.
[6] Howell: Text-Book of Physiology.
[7] Oettinger: Semaine Méd., 1903, xxiii, 213-217.
[8] Hoche: Bull. et mém. Soc. anat. de Par., 1903, lxxviii, 603-606.
[9] Graham (C.): Gastric Ulcer, Boston Med. and Surg. J., 1906, 193-195.
[10] Wilson and MacCarty: Amer. Jour. of Med. Science, Dec., 1909.
[11] MacCarty: The Pathology of Gastric Ulcer, read before A.M.A., June, 1909 (in print).
[12] Ochsner: Phila. Med. Journ., 1909, Oct. 6. ANNALS OF SURGERY, vol. xxxv, p. 708.
[13] Adami: Montreal Med. Jour., xxxi, 1902, 105.
[14] Maffucci: Giornal Internaz. della Scien. Med., 1882, page 889.
[15] Charcot and Gombault: Archiv de Physiol. norm. et path., 1876, second series, t. iii, p. 272.
[16] Meyer: Medicinisches Jahrbuch., Vienna, 1872.
[17] Tsunoda: Virchow's Archiv, Bd. 193, Hf. 2, 1908.
[18] MacCarty: Virchow's Archiv, Bd. 185, S. 483-517.
[19] Talma and Clebs: Quoted from Fenwick's Ulcer of Stomach and Duodenum.
[20] Litthauer: Virchow's Archiv, Bd. 195, Hf. 2.
[21] Roger: Archives de Médicine Experimentale, 1906, vol. xviii, p. 51-57.
[22] Hedblom and Cannon: Amer. Jour. of Med. Science, Oct., 1909.

PANCREATIC HEMORRHAGE AND ACUTE PANCREATITIS.

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At the Thirty-second German Surgical Congress in 1903, Bunge was enabled to record only three successful operations for acute pancreatitis, reported respectively by Halsted, Hahn, and Koehler. A fourth case operated on by Henle in Mikulicz's clinic was not included. In Halsted's case only a laparotomy was done. Several years later the patient recovered from a similar attack without operation. Dr. Halsted tells me in a personal communication, that he saw this patient last about four years ago and that he was very anæmic and weak and had only a short time to live. Whereas this shows that an acute hemorrhagic pancreatitis may be recovered from, despite laparotomy. Ebner in his statistics of two years ago tabulated 20 unoperated cases with 2 recoveries and 36 operations with 17, or 47.2 per cent., recoveries.

Early in 1908 Mayo Robson collected 59 operations with 23 complete recoveries. He himself had four operations with two successes. It is more than likely that a very considerable number of cases has been operated upon, which, because of unfavorable ending, have not been reported. Nor does Mayo Robson in the valuable contribution referred to enter upon details as to the nature of the individual cases operated upon. Operations for acute diseases of the pancreas have, after all, been so few in number, that at the present writing it may still be worth while to report every case.

Until a year ago no case of this kind came into my surgical service in the Cincinnati Hospital, nor do the records of the institution, where 300 autopsies are made annually, show that, except in one case to be presently reported, death had resulted from acute pancreatic disease. This is particularly interesting in view of the fact that the three cases, which I

beg to submit, all occurred in the West Surgical Service of the house and were all entered during the month of March of this year. They all had one feature in common. It was that a diagnosis was not made until the operations were well advanced. In one of the cases, which I report through the kindness of Dr. Griess, a perforated ulcer of the stomach or a rupture of the gall-bladder was suspected. In one of my cases a high intestinal obstruction was supposed to account for the fulminating symptoms and in the third the diagnosis of a perforating appendicitis had been made.

All of the cases were first received in the medical service and after a varying number of hours referred for operation. If an explanation or apology seems in place for the inaccuracy of the diagnosis, it must be found in the hyperacuity of the onset and progress of the symptoms.

In the last publication of Robson, he subdivides the cases of hæmorrhagic pancreatitis into acute and the ultra-acute. With the latter all of the cases to be reported may, I think, be properly classified. The desperate strait of the patient precludes the possibility of obtaining an anamnesis and the many time-consuming laboratory tests, which are indispensable in all less acute conditions, are manifestly out of place. They belong to that fortunately fast decreasing category of cases in which we recognize some great intra-abdominal disaster, the nature of which only an operation or autopsy may reveal. Since the latter possesses only a scientific and, therefore, relative advantage in the concrete case, unless it be moribund, the former has certain unqualified advantages. Fourteen years ago Thayer believed himself fortunate in having been enabled to follow six cases to the autopsy table. It certainly could not have been less fortunate had they been seen on the operating table before exitus.

CASE I.—Peter F., aged sixty-seven, hod-carrier, was admitted to medical service March 24, 1909. Has no memory of sickness, except an attack of influenza twenty years ago. States that he had a paralytic stroke five years ago, which involved the right

side, but from which he recovered. Has had one previous attack of pain in the abdomen, but does not remember when it was. Has had a right inguinal hernia for many years, but had no trouble from it, though it is down most of the time. Uses alcohol moderately. States that on the morning of his admission, while at work, he was taken with excruciating pain in the upper part of the abdomen. States that he has not had a movement of the bowels for two days. Patient's temperature 97, pulse 108, respirations 36.

Examination shows him to be a well-developed, fairly nourished man with marked arteriosclerosis. Heart and lungs negative. Urinalysis negative. Complexion sallow with almost a yellowish tinge. Pupils show slight tinge. The abdomen is quite tense, slightly distended above the umbilicus and painful to touch over its entirety, although more markedly so on the right side. There is an old inguinal hernia, which is reducible, but cannot be retained in place.

Treatment: Morphia ¼ gr. hypodermically for pain. A high purgative enema was given without any effect. Calomel was ordered to be given in broken doses and to be followed by saline in the morning.

March 26, patient vomited a great deal during the night. Much of the vomiting is regurgitant in character. It consists of bile-stained fluid. A second enema of glycerine and olive oil was administered, likewise without results. The patient's general condition rapidly becoming worse, he was referred to the surgical service.

The operation was performed at 4 P.M., twenty hours after his admission to the hospital. Incision above the umbilicus through the right rectus. When the peritoneum was opened, it was found full of free blood, much of which was in large clots. The incision was rapidly enlarged in order to remove the free blood as quickly as possible and to determine its source. It soon became evident that the bleeding came from under the liver and through the foramen of Winslow. Here a large hæmatoma was found behind the stomach and evidently in relation with the head of the pancreas. The hæmatoma was as large as two fists. It was incised through the lesser omentum and clots removed as quickly as possible. While pressure was made upon the sac with one hand, two large tampons of gauze were pressed in

from behind. Anything like a fat necrosis, if it had been present, would have been seen. The gall-bladder showed many adhesions, but because of the miserable condition of the patient it was not explored. The abdominal wound was closed with drainage. Intravenous stimulation with salt solution was given at 7.30 P.M. At 10.30 P.M. the dressings were changed because they were saturated with blood. Death at 11.40 P.M., eight hours after operation.

Necropsy by Dr. Hegner.—Hæmorrhagic pancreatitis; cholecystitis; cholelithiasis; chronic parenchymatous nephritis; chronic gastritis; chronic catarrhal duodenitis-enteritis-colitis; fatty, cloudy liver; lobular pneumonia; dilatation of heart; arteriosclerosis.

Post-mortem rigidity absent—staining slight. Chest emphysematous. Abdomen wound of recent laparotomy to right of right rectus muscle, from which drain protruded. On opening thorax both pleura free, excepting the right posteriorly, where rather firm adhesions were noted. Right lung 835 markedly œdematous and showed beginning lobular pneumonia. Left lung 810 showed similar condition. Heart and pericardium free 360—aorta at its origin was markedly dilated, same condition obtained throughout; atheroma was not marked. Aortic ring dilated—valve showed pronounced sclerosis at bases, calcareous deposit being present. Mitral leaflets moderately thickened. Right heart markedly dilated. Myocardium pale, almost bloodless. On opening abdominal cavity found peritoneal cavity filled with partially coagulated blood. Gauze aprons (2) were present and removed with the coagula. Omentum thickened and contracted and rolled on itself firmly adherent in region of gall-bladder and spleen. It showed several old, firm scars. On lifting the liver, the gall-bladder showed very firm, extensive, pericystic adhesion to stomach, colon and omentum and head of pancreas tissues all very soft and œdematous; turbid fluid noted here. Coagula were much more firm in this region; lesser peritoneal cavity opened and found filled with coagula. Bowels removed were soft and torn very easily. An opening admitting two fingers was found leading to the region of the head of pancreas.

Pancreas: Head firmly adherent to duodenum—gall-bladder under surface of liver was almost completely disorganized and replaced by coagula, the ducts were patulous. Exact point of origin of hemorrhage could not be definitely located, but was in the head of the pancreas. The remaining portion was very soft and œdematous and quite small.

Liver: 1465 was small, very pale, friable and markedly degenerated.

Gall-bladder walls thickened and showed marked pericystic adhesions to surrounding structures; contains turbid fluid similar to that noted above. One mulberry calculus, size of cherry stone, and numerous small yellow calculi. Ducts patulous.

Spleen: 75 small, markedly fibrous capsule, markedly thickened.

Kidneys: āā 185, bloodless, cortex irregular pyramids, fibrous capsule strips moderately, vessels sclerotic.

Bladder and prostate normal.

Stomach distended, mucosa markedly atrophic.

Duodenum showed extremely catarrhal changes; mucosa in relation with pancreas extremely congested throughout entire small and large intestine, most pronounced in duodenum was noted extremely tenacious and abundant pale mucus. In the colon this was very tough and adherent.

Pathological histology, by Dr. Whitacre.—Hæmorrhagic pancreatitis cloudy and cirrhotic liver, interstitial myocarditis.

Pancreas: Considerable new connective tissue between glandular elements, more in some places than others, the epithelial cells in spots show much cloudy swelling, the blood-vessels are thickened. One part shows extensive hemorrhage, part of which shows much degeneration. The tissues in this region are so changed by hemorrhage as to obliterate evidence of structure.

Kidney shows considerable evidence of connective tissue in places, other places comparatively free, much cloudy swelling tubules, vessel walls thickened, also Bowman's capsule in places more than others; some glomeruli are obliterated, other comparatively free from connective tissue. Liver shows cloudy swelling and small amount of cirrhosis.

Heart shows increase in interstitial connective tissue.

CASE II.—John D. W., aged thirty-six, married, patrolman (case of Dr. Griess). Admitted March 25, 1909. Patient very fleshy man, has been addicted to alcohol excesses. Has frequently pain in the abdomen, but no attack like the one for which he seeks admission. Has occasionally vomited. The present attack began with excruciatingly severe pain in upper part of abdomen early in the morning. The pain was associated with vomiting. The vomitus was yellowish in color and bitter. On admission, patient was found to be a very large, well-developed male with a good deal of excess of adipose tissue in the abdomen. The abdomen was distended, rigid and painful to pressure above the umbilicus and to the right. There were frequent spells of vomiting, the fluid being bile-stained. Temperature on admission was 100, pulse 100, respirations 28. A perforating ulcer of stomach or a ruptured gall-bladder being suspected, the patient was transferred to the West Surgical Service.

Operation performed at 6 A.M. under ether anæsthesia. The incision made to the right of the median line above the umbilicus. On opening the peritoneum a blood-tinged effusion with a considerable number of clots escaped. The effusion could be traced as coming from the foramen of Winslow. A number of areas of

fat necrosis were found on the omentum. The gall-bladder and appendix were normal, nor was any trace of ulcer of the stomach found. The operation was completed with tubular and gauze drainage and the abdomen closed.

While the immediate result is noted as having been good, exitus occurred on the third day from peritonitis. A postmortem was not made.

CASE III.—George S., aged twenty-four, male. Was admitted on the evening of March 14, 1909, to the medical service. In the receiving ward he was supposed to have had an intestinal grippe. There was no history of any injury at the time. Had there been, he would have been referred directly to the surgical service. The patient is a laborer in a dairy and seems a little lacking in intelligence. Gives no history of an injury on admission, or while in the medical service. While his recovery was in process and a week or more after the operation, he stated that he had fallen some days before from a hay-mow and struck his side. It pained him a great deal and he had difficulty in getting to the house. For three or four hours before admission, the pain was associated with severe vomiting and hiccoughing.

Examination shows a well-developed and well-nourished man. The tongue is coated, breathing regular with normal breath sounds. Heart sounds normal. The abdomen somewhat rigid and tender to pressure throughout. It seems, however, that the tenderness is most acute in the lower right quadrant. Liver dulness pushed up. Temperature 99, pulse 88, respirations 26. The pulse is of very good tension and regular. The urine slightly cloudy, acid, 1028, contains albumin, granular and epithelial casts. Extremities negative.

Treatment: Ice cap to abdomen, enema, morphia sulph. ¼ gr. hypodermically for pain.

March 15: Temperature 99, pulse 100 and a little weak. The abdomen is more rigid and tenderness more marked; especially over the right side, low down. The patient continues to vomit frequently a greenish fluid.

A probable diagnosis of appendicitis was made and the case referred to the West Surgical Service.

Operation: March 15, 1909. Right pararectal incision three inches in length. When the peritoneum was exposed, free blood in large quantities could be seen through it. When the peritoneum

was opened, a large quantity of dark free blood with a considerable number of large clots flowed from the wound. The escape of blood was so profuse, that it look as though an aneurism might have ruptured. The head of the bed was immediately lowered and an intravenous salt solution given. The appendix was found normal. The abdominal incision was rapidly lengthened upwards and downwards and the bleeding was found to come from beneath the liver. It was packed with gauze temporarily, so that the lower part of the abdominal cavity could be cleansed. It was found intact. There was no trace of any fat necrosis. The gall-bladder seemed normal. Through the lesser omentum and behind the stomach a bogginess was felt, but not interfered with. Attention was then given to the site of the hemorrhage and the gauze packs, temporarily placed there, were removed. The bleeding was found to come from the foramen of Winslow and was venous in character.

As far as possible, the under surface of the liver was explored and the pancreas, but no injury of either was found. There was a bogginess easily perceptible behind the stomach and the gastrohepatic omentum. Large, wide gauze packing was inserted into the foramen and drainage through the anterior incision provided for. The great omentum was fixed against the parietal layer to shut off, as far as possible, the lower part of the general peritoneal cavity. Except for the drainage, the wound was rapidly closed with interrupted sutures. The pulse had become very weak and the respirations 30.

March 16: Patient's temperature was 100.2, pulse 142 quite weak. Still vomiting greenish fluid from time to time. The dressings were saturated and were, therefore, reinforced. The Cammidge reaction, repeatedly made, was negative.

March 17: Vomiting has stopped and the bleeding is evidently at a standstill. Maximum temperature 99½°, pulse 130. The last of the packing was removed on March 25.

April 20, 1909, the patient was discharged with the wound perfectly healed and well in every way.

In considering the cases reported, no question can enter as to the existence of a pancreatitis in the first and second. The third may be open to the view that an injury of the pancreas had existed. As has already been stated, no history of an

injury was given by the patient at the time of admission, for he was referred to the medical service. When he was well on the road to recovery, he spoke of a fall from a hay-loft. The operation revealed no tear of the pancreas or the liver, although the former may have existed. If so, the operation was a life-saving one.

According to Mikulicz, of 13 unoperated cases of subparietal rupture of the pancreas, all died; whereas, of 11 operated cases, 7 recovered. Considering that this case also was one of pancreatic disease, two of the three cases may justly be called of the ultra-acute type with the hemorrhage a predominant phenomenon. Although in these cases the intraperitoneal bleeding was more profuse than one generally sees it in ordinary gunshot injuries, one feature of the condition of the patients, at the time of the operation, was no index of the great gravity of the cases. In the first the pulse was 108 and regular; in the second one, 100; and in the third one 88. The tension in all of the cases was good. It is difficult to understand this seeming discrepancy between the pulse rate and tension on the one hand and on the other hand the severity of symptoms, which so clearly portray a grave intra-abdominal lesion. The same slow pulse is, as a rule, encountered during the early stages of an acute intestinal obstruction. The great violence of the pain and the persistent vomiting and evidence of shock, other than those of cardiac nature, are common to both conditions.

It has been a question whether the hemorrhage precedes or follows the disorganization of the pancreas, which leads to localized fat necrosis. Two of the above cases appear to establish the fact that in the ultra-acute cases, hemorrhage precedes the fat necrosis and that even in autopsies, if death follows quickly, fat necrosis may not be found. These are cases of pancreatic apoplexy. They are probably in the beginning, at least, not of an infectious nature. Hlava has found both the intraperitoneal effusion and the exudate within the pancreas sterile. If life be continued long enough, infection can easily occur through the channel of the ducts or

from the adjacent hollow viscera. If life be prolonged, the disorganization of the gland, consequent on the hemorrhage, sets free its secretion, which in turn causes fat necrosis. The literature of these cases seems to bear this out, since, as in cerebral apoplexy, most cases of acute hemorrhage from the pancreas have been found in obese individuals and mostly males, in whom the habits or an old syphilis predisposed to arterial lesions and to thrombotic processes in the vessels. Mikulicz very ingeniously believed in a vicious circle, the first factor of which is a lesion of possibly a small vessel. Disorganization of that part of the pancreas takes place and is followed by a localized necrosis of the gland with the setting free of some of the secretion. Autodigestion ensuing, a larger vessel would be involved and a profuse hemorrhage is the end result.

The relationship, which is supposed to exist between gall-stone disease and acute pancreatitis, was confirmed in one of the three cases and might have been suspected from the subicteric tinge of the skin. In this case a possible rupture of the gall-bladder was thought of, but in the absence of a localized jaundice of the umbilicus, which the writer has seen in two cases, was held to be improbable. Free bile in the peritoneal cavity from any cause is likely to show itself first by a tinge of yellow at and about the navel. Severe vomiting of a bile-tinged fluid was present in every one of the cases and I might state occurs in a preponderance of the cases reported. This is interesting in view of the fact, that a mechanical obstruction near the outlet of the common duct or within the diverticulum of Vater, is commonly held to be the immediate etiological factor of acute pancreatitis. If this is true, how can the vomiting of bile be explained? The discrepancy can only be explained on the theory that the disease of the pancreas is either an infection or the result of some form of chemical autodigestion due to primary vascular lesion with hemorrhage.

Whereas in the ultra-acute cases such as I have described, the diagnosis before operation may always remain conjec-

tural, in the less acute ones, where hemorrhage is less profuse and a localization of the exudates takes place, it is certain that the recognition of acute pancreatitis will become more and more simplified. With the development of an abscess, the well-known physical characteristics of pancreatitic enlargements, as typified by cysts, are developed and as in the latter the diagnosis must become relatively easy. That, where time will permit, a most careful examination of the urine and fæces should be made goes without further comment.

The writer would here like to protest against the glib manner in which the diagnosis of chronic pancreatitis is sometimes made in the course of an operation for gall-stone disease, in which the findings are negative. To make this diagnosis as it so often is made by the sense of touch alone appears to me unscientific in the extreme and unwarranted. For example, according to Robson, 113 operations have been performed for chronic pancreatitis with eight deaths. It would be interesting to determine, if it were possible, in how many of those that recovered, the diagnosis was based on the clinical evidences, which we know belong to chronic pancreatic disease and in what number the diagnosis was made by the sense of touch alone. To any one made familiar in the mortuary or the operating room with the great variation which normally exists in the density and hardness of the gland, the uncertainty of making a diagnosis during an operation by touch and sight must be at once apparent. Prof. Paul Wooley, pathologist of the University of Cincinnati, bears me out in this, with the statement that in all the autopsies he has made he has been enabled in only two instances to make the diagnosis of chronic pancreatitis from the gross findings.

In regard to the treatment, much has been written regarding inadvisability of operating the first day or hours of a fulminating hæmorrhagic pancreatitis under the belief that an operation will hasten death. Unfortunately, as Deaver says, a cursory examination of recorded cases will show that in 90 per cent. the correct diagnosis was not made, except at operation. A year ago Noetzel reported a case, which was

not recognized at the first operation and the second made the condition clear. It is evident, that until some more definite early symptoms shall in the future be recognized as belonging to ultra-acute pancreatitis, the discovery of its existence during an operation must yet come to many of us as a disagreeable surprise.

As has already been indicated, shock, as evidenced by the pulse rate and tension, is at times not great enough to make an operation appear extra hazardous. Since the condition is often mistaken for rupture of the biliary ways, of perforating ulcer and for high intestinal obstruction, conditions in which we recognize immediate operation as imperative, cases of the disease under consideration will continue to be operated upon as soon as possible. There can be no question but that, since abscess and gangrenous cases operated upon have shown a more favorable post-operative percentage of recovery, the waiting method would seem a preferable one, where the symptoms are not urgent enough to demand immediate interference. The history of these cases for the most part excludes them from the ultra-acute type.

When an abscess has formed, it is a relatively simple matter to drain it through the abdominal incision or through an incision in the loin. Surely, the abdominal incision will continue to be sufficient in most cases. The drainage of cysts of the pancreas, with which surgeons have long been familiar, has made this certain. The danger of general peritoneal infection, if it has not already existed at the time of the operation, may be minimized by properly placing gauze tampons and utilizing the omentum before partly closing the incision.

The expediency of operating on the pancreas itself must be considered in each case. According to Mikulicz, of 41 cases in which the pancreas was not touched, four cases recovered. Of 37 cases in which the pancreas was involved in the operative interference, 25 recovered. Mikulicz himself limits the value of these statistics and I should not call attention to them at all, were it not for a remarkable critique of Eberth, which appeared two years ago in which he states that the fatalities

after operation may largely be ascribed to the incompleteness of the operation in that the pancreas itself was not attacked. This view, widely circulated in Volkmann's "Klinische Vortraege," should, I think, be challenged.

While the writer's experience is limited, he believes that the condition of the patient as the operation progresses must guide the operator as to the extent of the operation. If the grave condition of the patient from hemorrhage limits operative interference, drainage through the foramen of Winslow or through an opening made into the omental bursa with sequestration of the disease by gauze packing, all of which can be quickly done, will assuredly save many a patient, to whom further interference might be disastrous. When a phlegmon of the pancreas is clearly made out, the general surgical principles guiding us in like conditions elsewhere must guide us here as well.

RETROPERITONEAL HERNIA OF THE PERICÆCAL TYPE.

REPORT OF A CASE WITH REFERENCES TO THE LITERATURE

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RETROPERITONEAL hernias, especially of the pericæcal variety play a rather insignificant rôle in the surgery of the abdominal cavity, and little stress is laid upon their importance either in text-book or monograph. It has been the writer's good fortune to observe an interesting case of the pericæcal variety, and on account of its rarity he has been inspired to look up the literature of this special type. He is surprised to find few cases reported and that in many of these cases the surgical literature contains little that is definite and complete.

While works on retroperitoneal hernia have been before the medical profession since the middle of the nineteenth century, we find a paucity of works by English surgeons. The subject was first brought to the attention of the profession in book form, I believe, by Treitz [1] in 1857 and later by Waldeyer [2] in 1868. Since the publication of these works a few others have followed in German, three in French, and only one, that I can find, in the English language—Moynihan.[3] The first published work on retroperitoneal hernia dealing in particular with the pericæcal variety that I have been able to find is that of Pascal [4] in 1897.

By the term pericæcal hernia we mean of course one situated in the neighborhood of the cæcum and bearing a definite relation to one of the fossæ found in this region. It would be going beyond the limits of this article to describe the various folds giving origin to the different pericæcal fos-

sæ, but in order that an intelligent understanding of the varieties of hernias to be mentioned later may obtain I will refer briefly to the pericæcal fossæ.

Pericæcal Fossæ.—Moynihan [3] says that the first description of any fossæ in this region was given by Santorini [5] in 1775, but until 1834 no further mention was made of it. The vagueness of, and the complicating statements made by the early writers upon this subject is evident on investigation. Moynihan quotes Sir. F. Treves,[6] who says, "I might be allowed to say that the accounts given of these pouches are somewhat involved and are frequently contradictory, and I might venture to add are also incorrect. Certain fossæ are described as constant which are extremely rare. . . . The subject has suffered from a reckless and exuberant nomenclature, etc." Moynihan refers to the best early work on this subject, by Waldeyer,[2] who described four fossæ. 1. Recessus ileocæcalis superior (ileocolic). 2. Recessus ileocæcalic inferior (ileo-appendicular). 3. Recessus cæcalis. 4. Recessus subcæcalis (retrocolic).

That the third variety (recessus cæcalis) is not of particular importance from a pathological point of view is shown by the fact that Macewen [7] in 1904 did not mention it when describing the pericæcal fossæ. He gave only the ileocolic, ileocæcal (ileo-appendicular), and subcæcal. While there is no agreement relative to the frequency and nomenclature, the following fossæ are usually mentioned in descriptive works and may be considered the most constant.

The *superior ileocæcal* (*ileocolic*) *fossa* lies just above the ileocolic junction between the end of the ileum and ascending colon, bounded in front by a fold known as the ileocolic. It is just where the mesentery changes into the peritoneal coat of the ascending colon. It is small and may disappear in adult life. It is only of anatomical interest as it has no pathology.

The *inferior ileocæcal* (*ileo-appendicular*) *fossa* lies between the ileo-appendicular fold and the mesentery of the

vermiform appendix. It is really underneath the ileum, between it and the cæcum. On section it is somewhat triangular in shape. It varies much in size and capacity. Treves says that the pouch will commonly lodge two fingers as far as the first joints, while there may be only a mere chink visible. Moynihan states that two cases are on record in which it is believed that the fossa had been closed at its mouth and subsequently dilated to form a cyst. The cases were recorded by Schott. One was seen by Widerhofer in a child eighteen months old; it was full of colloid material and was the size of a walnut. The second contained a clear serous fluid, was tightly distended with thin, tense walls, and was equal in size to an apple.

The *subcæcal fossa* lies directly behind the cæcum; it is really postcæcal. Its fundus may pass up behind the ascending colon. It appears that this fossa and the ileocæcal fossa are about equally susceptible to hernia. Of the latter there have been seven authentic cases reported, while eight have been noted, including the author's case, in the former.

Treitz (quoted by Moynihan) in discussing the occurrence of hernia into the subcæcal fossa refers to two examples only. The first is that of Snow,[13] which has not been accepted as an authentic example. The second, that of Wagner,[14] is considered by those who have given the subject thorough study as quite unlikely a case of subcæcal hernia. Moynihan refers to a case of Fayes,[15] Wagner[14] (one mentioned above), Parise,[16] three cases by Rieux,[17] one by Engel,[18] Klebs,[19] Moxon,[20] Josse,[21] Furst,[22] Aschoff,[23] Mansell Moullin,[24] Neumann,[25] Funkenstein,[26] and Atherton.[27] Of these he accepts as fairly authentic cases only those of Aschoff, Monsell Moullin, Atherton, Neumann, Funkenstein, and the last two cases of Rieux—seven cases in all. The recognized cases are of sufficient interest to warrant a brief description of each. These cases, as well as those of the ileocæcal class, are reviewed by Moynihan,[3] to whom I am indebted for much assistance. As the author's case belongs to this subcæcal class,

I will first give you the results of my personal observation.

AUTHOR'S CASE (Case VIII).—O. S., a male, aged 69, was admitted to the Hudson River State Hospital, August 7, 1908, in a feeble physical condition, with an anxiety psychosis of four months' duration. Patient was a native of England and came to the United States 18 years before. He was married, but had known nothing about his wife for many years. Was a clerk by occupation, but since he came to this country had turned his hand to various occupations.

The initial examination showed an emaciated man of delicate frame; small thorax, with shallow auscultatory signs; weak heart action without murmurs; pulse regular, 75 per minute; marked arteriosclerosis; varicose ulcer of right leg; defective audition; small pupils which were slightly irregular in outline and showed limited excursions; soft abdominal walls, no areas of tenderness; normal liver and spleen outlines; hæmorrhoids, constipation, and anorexia.

Patient failed gradually both physically and mentally and was bedridden much of the time before his last illness. His failure was attributed to defective nutrition dependent upon the marked arteriosclerosis. However, he had been up and dressed for about four weeks before his fatal illness, though he was feeble and often required assistance in getting about.

April 27, 1909: During the morning patient complained of not feeling well. He ate very little breakfast, which was not an unusual occurrence for him, after which he was requested to lie down. About 2 P.M. he was taken ill with nausea and vomiting. At this time he admitted for the first that he had been having abdominal pains, though slight in character, since 2 A.M. Physical examination showed the abdomen slightly and uniformly distended with slight general tenderness, but without areas of localized tenderness. No rigidity. Temperature 99 degrees F., pulse 80, respirations 20. As he had had but one small stool the day before he was placed upon divided doses of calomel.

April 28, A.M.: Patient much worse. He vomited frequently during the night a greenish yellow fluid. Had a small stool semi-formed. No distinct change in condition of abdomen except that the distention was a little more marked on the right side. There was still slight general tenderness on moderate pressure. Deep

pressure disclosed nothing abnormal, not even an accumulation of fæces anywhere. Rectal examination negative. Temperature, 8 A.M., 99 degrees F., pulse 80 and feeble, respirations 20.

Afternoon: Did not succeed in moving the bowels this morning with stimulating high rectal enemata. Nausea and vomiting continue. Failing rapidly. On deep palpation there was now located a small tumorous mass, apparently about the size of a large watch crystal, in the right inguinal region just at or slightly above the internal ring. This mass was somewhat sensitive to pressure and appeared rather soft. At this time a diagnosis of intestinal obstruction was made and a fixation of a knuckle of gut at the internal ring was thought of, but the mass seemed too deeply situated for such a condition. Patient was in practically a moribund condition; operation not attempted.

The autopsy was performed by Dr. Carpenter, the hospital pathologist. Upon opening the abdomen *a loop of the ileum at a point about two feet from its junction with the cæcum was found bound down at a point beneath the cæcum. On raising the cæcum the intestine was seen to enter a narrow opening in the peritoneum and to follow a fossa leading toward the right side of the cæcum. This fossa included about 6 inches of the ileum which was dark red in color, intensely injected and œdematous, but apparently viable. . . . At either end of the loop a markedly constricted ring was found corresponding to the site of pressure from the peritoneal ring.*

AUTHENTIC CASES OF SUBCÆCAL HERNIA PREVIOUSLY REPORTED.

CASE I (RIEUX[17]—1853).—Male, aged 44. Death from obstruction. The intestinal distension continued to the level of the ileocæcal valve. At this point the last portion of the small intestine was found underneath the cæcum, and about 5 centimetres of collapsed gut were withdrawn. He described it as "caught in a sort of cavity bounded by peritoneum, closed below by a tight peritoneal band, and in part by the cæcum. The cavity admitted about half the length of the little finger."

CASE II (RIEUX[17]—1853).—Infant of 15 months. Death from acute pneumonia. He says "four or five centimetres of small intestine penetrated into an abnormal cavity beneath the cæcum, about four centimetres in depth, entirely lined by peritoneum; the aperture of entry was bounded by two slight ridges of peritoneum. There was no sign of any obstruction to the passage of food along the canal." A very incomplete description but probably a subcæcal hernia.

CASE III (ASCHOFF[28]—1896).—The patient was a female, aged 48. She was suddenly seized with an acute pain in the right lower abdomen.

Constipation followed, but enemata on two occasions brought away a little fecal matter. On the twenty-first day an operation was performed by Karts.

The small intestine was found immensely distended, the ascending colon, cæcum, and the termination of the ileum were collapsed. A coil of intestine was found in a pouch behind the cæcum and ascending colon. The ascending colon had an immensely long mesentery. The strangled gut was withdrawn and the patient made a good recovery.

CASE IV (MANSELL MOULLIN [24]—1899).—Male, 40 years of age, was suddenly seized with griping pain in the epigastrium; vomiting set in on the following day and continued. On admission on the fourth day he complained of pain chiefly in the right ilial fossa; pulse 98, tongue dirty and dry. The abdomen was moderately distended and was soft and resonant on percussion except in the right iliac fossa. It was sensitive to pressure but was not particularly tender. In the right iliac fossa there was more resistance and on palpation a fairly well-defined swelling could be felt, rounded above and not reaching higher than the umbilicus. Per rectum there was a soft bulging mass in front and on the right side. There was no vomiting on the day of admission and the bowels moved twice after enemata, though the movements were small.

The patient said he had suffered from four previous attacks of a similar character which had subsided in three or four days. A diagnosis of appendicitis was made.

On opening the abdomen, the surface of the intestine was seen to be reddened and to have lost its polish, but there was no lymph or pus. The distention was only moderate in degree. On passing the fingers down towards the cæcum a ring was felt around some intestine. It passed inwards towards the middle line and slightly downwards. The finger-nail passed easily underneath it and at once some brownish, offensive fluid, similar in character to that which he had vomited on the last occasion, began to escape. The general peritoneal cavity was then packed off with iodoform gauze, a drainage tube passed close to the opening, and the wound left widely open. The patient died the same day.

At the post-mortem examination, a loop of the ileum was found lying in a sac behind the cæcum, communicating with the general peritoneal cavity by an opening a little more than an inch in diameter. The ileum had ulcerated through and there was general septic peritonitis.

CASE V (NEUMANN [25]—1901).—Illness began with severe pain in abdomen and vomiting. On examination the patient was extremely collapsed, feeble pulse (110 per minute), temperature normal. The abdomen was moderately distended, the muscles were rigid, particularly the left rectus abdominis. Pressure on the abdomen, particularly in the left hypochondrium, was extremely painful. Here the patient localized the pain. Visible peristalsis was absent. Rectal examination negative.

The abdomen was opened and after partial evisceration, a distended intestine was seen running to the right behind the cæcum. A loop of small intestine 10 centimetres in length was found to be strangled

in the retrocolic fossa. The loop was liberated without great difficulty.

On lifting up the cæcum, a rounded opening with sharp-edged margins was seen which would admit two fingers. This led into a peritoneal pouch extending upwards behind the ascending colon. In this pouch the intestines had been strangled. The patient recovered.

CASE VI (FUNKENSTEIN [26]—1902).—Patient was operated upon the fifth day for acute intestinal obstruction. On opening the abdomen, distended coils of small intestine were traced to the right side, where a loop of intestine was found to be strangulated by a hard, firm ring. The affected gut was readily withdrawn and the abdomen rapidly closed, the condition of the patient being critical.

At the postmortem an opening was found behind the cæcum, with rounded, firm edges, 2 centimetres in diameter. Through this the finger could be passed into a sac running up behind the cæcum and ascending colon as far as the upper margin of the ileum. The strangled portion of intestine was easily recognized. No band, adhesion, or other aperture was found which could have caused the strangulation. This seems a fairly good example of a strangulated hernia into the subcæcal fossa.

CASE VII (ATHERTON [27]—1903).—Dr. Atherton has kindly forwarded me a copy of his article. From a perusal of its contents, one can say without hesitation that he was dealing with a hernia into the subcæcal fossa.

For a year a man, aged 33, had complained of more or less pain and soreness in his right inguinal region, running across the lower abdomen. He sought assistance at the doctor's hands, who could find no evidence of disease on physical examination. As he had never had to give up work, had lost no flesh, a neurotic condition was thought of. He returned later and demanded an operation which was performed, as he said his trouble was preventing him from carrying on his usual farm work satisfactorily.

An incision was made and an apparently normal appendix removed. The pelvic and hypogastric regions were then explored. One or two of the appendices epiploicæ were found adherent in the pelvis and freed. Nothing further being found the wound was closed.

For the first 24 hours after the operation the patient seemed much the same as after any ordinary laparotomy case. Then vomiting began and occurred every few hours. The following day it was more severe, although there was not very much pain. An attempt was made to open the bowels without avail. Meantime the vomiting grew worse, and pulse ran up to 112. The temperature never rose above 99 degrees. Considerable abdominal distention developed. During the third night the vomit became distinctly intestinal in appearance and odor. The following morning pulse was 136 and weak, temperature 100.

A few sutures were removed and about three drachms of dark blood-stained serum and a few bubbles of gas escaped. A portion of the bowel in the right iliac fossa was felt to be harder than the rest. After slight traction a knuckle of gut about 2½ inches long was released. It

was quite black and with an opening near its middle one-third of an inch long. The line of demarcation between the living and dead bowel was clearly defined. Resection was done but patient failed rapidly.

Autopsy revealed a somewhat distended cæcum. There was no sign of old adhesions anywhere to account for the strangulation, but in the locality from which the gangrenous knuckle of gut was obtained there was a pouch about an inch deep and with an opening of the same diameter. It was situated just to the outer side of the lower end of the cæcum and partly behind it.

I quite agree with Dr. Atherton in his conclusion that the uncomfortable feelings in this region which led the patient to seek advice were probably due to the occasional entanglement of a loop of the bowel in the pouch. The acute obstruction was the result no doubt of the operation. The bowel, having re-entered the fossa, became distended as result of the previous handlings and could not release itself as heretofore.

REPORTED CASES OF ILEOCÆCAL (ILEO-APPENDICULAR) HERNIAS.

CASE I (TUFFIER[8]).—A man of 50 years, condition disclosed at autopsy. An intestinal loop, which unrolled measured 8 centimetres, was contained in the ileocæcal fossa, which was very dilated, being enlarged upwards and backwards. Its base corresponded to the postero-inferior part of the cæcum, but there was no sign of a neck or strangulation; the bowels entered and left the sac without difficulty.

CASE II.—Case in Musée Dupuytren. Tuffier considers it a true specimen of ileo-appendicular hernia.

CASE III (T. E. LITTLE[9]).—A man aged 60, in good general health up until the moment of the fatal attack, nine days after the first evidence of which he died. On opening the body, all the organs were found to be perfectly healthy except those concerned in the lesion under observation. From a point near the tip of the vermiform appendix a narrow but strong whitish band was seen passing to an attachment in the front of the ileum at a distance of about 2 inches from the termination of the latter gut. Through the opening left between this cord and the appendix itself and its attachment, a large loop (16 or 18 inches in length) of that part of the ileum immediately above the attachment of the band alluded to was prolapsed and tightly constricted. The piece of gut strangulated was deep-brown color, much distended, and in a condition of incipient gangrene, the peritoneum stripping off it in most places under the mere touch of the finger.

It might seem as if the obstruction resulted from an abnormal band of adhesion, connecting vermiform process and the ileum, but on looking more closely to the particulars of the case we note that there was no pathological trace of peritonitis anywhere in the abdominal cavity, nor any abnormal adhesions. In addition, the peritoneum was carried over the constricting band uninterruptedly, just as over the neighboring organs. The report of this case was so full and complete and the accompanying drawing so convincing that we may without hesitation accept the case as ileo-appendicular hernia.

CASE IV (PARTRIDGE[10]).—A maid servant, aged 36, died after five

days' illness of acute obstruction. The post-mortem examination showed the small intestines greatly distended, the large bowel quite empty. Slight traces of peritonitis. A knuckle of the ileum, immediately above its termination, was found strangulated and much congested, in consequence of having passed through and become impacted in a hole or interspace in the mesentery of the vermiform appendix. The strangulated portion of the bowel was of a deep-red color, and some recent lymph was effused upon its peritoneal surface, as well as upon the surface of the adjacent parts.

CASE V (NASSE[11]).—Male, aged 46. For six days preceding his admission into the hospital he had suffered from severe abdominal pain, vomiting, and constipation. The operation showed that a loop of the ileum was strangulated in the ileo-appendicular fossa, and was released with little difficulty. The strangulated loop was not gangrenous, and was replaced within the abdomen. While suturing the abdominal wound the patient vomited fæculent matter; a quantity was aspirated into the air-passages, and the patient suffocated.

At the post-mortem examination the presence of a large ileo-appendicular fossa was confirmed.

CASE VI (H. RIESE[12]).—Male, aged 32. For about six months had noticed a small inguinal hernia which had not caused him any annoyance. Six days before admission he was seized with severe abdominal pain, followed by absolute constipation and vomiting. For 36 hours the vomit had been offensive. The patient was very collapsed, a small pulse (120 to 130 per min.). He complained of general abdominal pain, and particularly on pressure over the ileocæcal region.

There was considerable abdominal distention; no visible peristalsis. There was some feeling of resistance in the right iliac fossa. The hernia orifices were free, the right inguinal canal admitting the finger easily.

After a large injection there became evident at the inner side of the cæcum a uniform, smooth, firm swelling, giving a tympanitic note on percussion. A tentative diagnosis of a pericæcal hernia was made.

The operation showed a distended intestine which was traced towards the cæcum, and a loop of ileum was then found fixed between the cæcum and the vermiform appendix, the lower part of the ileum being collapsed. The loop was easily withdrawn from the ensnaring ring, which was, without doubt, the fossa ileo-appendicularis. The finger could be passed easily into the fossa which was of the size of a pigeon's egg. The patient recovered.

CASE VII (MACEWEN[7]).—Female, aged 56. The illness commenced five days before admission to the hospital, with abdominal pain and vomiting. The vomiting was incessant for 24 hours and then abated somewhat after a slight movement of the bowels. It only troubled her occasionally for the next three days, and then again become very frequent, and continued so till her admission 30 hours later. There was no further movement of the bowels or passage of flatus.

On admission she was exhausted, pulse weak, temperature 99 degrees; complained of abdominal pain, chiefly about the umbilicus. The abdomen

was distended and tympanitic all over. There was pain on palpation, but no localized tenderness. In the left groin at the femoral opening was a small tumor of doughy consistence and without impulse on coughing. Soon after admission she had two attacks of fecal vomiting.

The operation exposed the swelling in the groin which was found to be an enlarged gland. The abdomen was then opened. The intestines were distended and congested. The obstruction was found to be due to the engagement of a loop of the small intestine in a peritoneal pouch, the mouth of which lay to the inner side of the cæcum and appendix. The loop of intestine which was about 4 inches in length, was so constricted that the mouth of the sac had to be incised in order to disengage it. It was distinctly gangrenous, particularly at the points of constriction. It was an ashy gray color, and there was a perforation through which some fecal matter escaped. The sphacelated bowel was withdrawn from the abdomen, enterectomy performed, and the ends brought together by means of a Murphy's button, about 8 inches of bowel being resected. The patient made a satisfactory recovery, the button being passed six weeks after the operation.

CONCLUSIONS.

1. That pericæcal retroperitoneal hernia is a very rare condition, is shown by the fact that to date only 15 authentic cases have been reported, 8, including the author's, being of the subcæcal, and 7 of the ileocæcal variety.

2. *Mortality.*—In the reported cases of ileocæcal variety, one (Tuffier's) apparently gave rise to no symptoms. The post-mortem findings would indicate that the bowel entered and left the sac without difficulty. The second case was discovered in the Musée Dupuytren. No symptomatology obtainable. In the remaining five cases two recovered (Riese and Macewen's cases). Mortality 60 per cent.

There were 5 deaths in 8 cases of the subcæcal type, giving a mortality of 62.5 per cent.; making an average for the two varieties of 61.25 per cent. No doubt an earlier recognition of the symptoms of acute intestinal obstruction with the application of the principles of to-day's surgical technic will greatly lessen this mortality.

3. *Symptomatology.*—Though the description of symptoms in many cases is inadequate, it is quite likely that there are few, if any, features pointing to a differential diagnosis. Symptoms of acute, or possibly subacute intestinal obstruction, will obtain in practically all cases.

4. *Sex.*—Stated in five cases, 4 males and 1 female.

5. *Treatment.*—The therapeutics must necessarily be based upon the general principles of abdominal surgery.

Something will have been accomplished by this article if the surgeon's attention will but have been directed to the possibility of the presence of this trouble, either prior to or during an operation when he is face to face with an obscure abdominal case.

REFERENCES.

[1] Treitz (W.): Hernia retroperitonealis. Ein Beitrag zur Geschichte innerer Hernies, Prag, 1857.

[2] Waldeyer (W.): Hernia retroperitonealis nebst Bemerkungen zur anatomie des Peritoneums, Breslau, 1868.

[3] Moynihan (B. G. A.): On Retroperitoneal Hernia, being the "Arris and Gale" Lectures, "The Anatomy and Surgery of the Peritoneal Fossæ," delivered at the Royal College of Surgeons of England in 1897. Second edition, London, 1906.

[4] Pascal (E.): Des hernies intestinalis et appendiculaires dans la fossette retrocæcale, Lyon, 1897.

[5] Santorini, Tabulæ 17, Parma, 1775.

[6] Treves (Sir F.): The Anatomy of the Intestinal Canal and Peritoneum in Man, Hunterian Lectures, London, 1885.

[7] Macewen: Hernia into the Ileocæcal Fossa; Enterectomy; Recovery, British Medical Journal, I, 1904.

[8] Tuffier: Etude sur le cæcum et ses Hernies, Arch. Générales de Médicine, Juin 1887.

[9] Little (T. E.): Internal Strangulation: Anatomy of the Vermiform Appendix, Dublin Journal of Medical Science, vol. lii, 1871.

[10] Partridge: Internal Strangulation of the End of the Small Intestine (Ileum) Produced by its Passage Through an Aperture in the Mesentery of the Appendix Vermiformis. Pathological Society's Transactions, vol. xii, 1861.

[11] Nasse: Archiv. für klinische Chirurgie, li, 1896.

[12] Riese (H.): Archiv. für klinische Chirurgie, lx, 1900.

[13] Snow: London Medical Gazette, 1846.

[14] Wagner: Beobachtungen und abhandlungen aus dem Gebiete der Natur und Heilkunde: Einige Beobachtungen innerer Bruche, Med. Jahrbücher der K. K. Osterreichischen Staates, H. J. Freiherr von Stift, Ed. xiii, oder neue Folge, Bd. iv, Wien, 1833.

[15] Fages: Recueil Périodique de la Société de Médecine de Paris, tome vii, 1 septembre de l'an VIII de la République.

[16] Parise: Mémoire sur Deux varietes de Hernie, Mémoirs de la Société de Chirurgie de Paris, 1858, tome ii.

[17] Rieux: Considerations sur l'Etranglement de l'Intestin dans la Caviti

Abdominale et sur un mode d'Etranglement non décrit par les Auteurs, Thèse de Doctorat, Soutenue le 22 juin, Paris, 1853.

[18] Engel: Einige Bemerkungen über Lagever hältnisse der Baucheingeweide im gesunden Zustande, Wiener med. Wochenschrift, 1857.

[19] Klebs: Handbuch der Pathol. Anat., Bd. i, Berlin, 1869.

[20] Moxon (related by Pye-Smith): On Retroperitoneal Hernia, Guy's Hospital Reports, Series iii, vol. xvi, 1871, Pathological Society's Transactions, 1867.

[21] Josse: Hernies internes retroperitoneales, Paris, Steinheil, 1890.

[22] Furst: Nordiskt Mediciniskt Archiv, redigeradt uf Axel Key, sextonde Baudet, tredjc Häfet, Stockholm, 1884.

[23] Aschoff: Berliner Klinik, Oct., 1896.

[24] Moullin (Mansell): Lancet, April 1, 1899.

[25] Neumann: Deutsche Zeitschrift für Chirurgie, 1901, lviii.

[26] Funkenstein: Deutsche Zeitschrift für Chirurgie, lxiv, 1902.

[27] Atherton: ANNALS OF SURGERY, 1903, vol. xxxvii.

AN OPERATION FOR UMBILICAL HERNIA.

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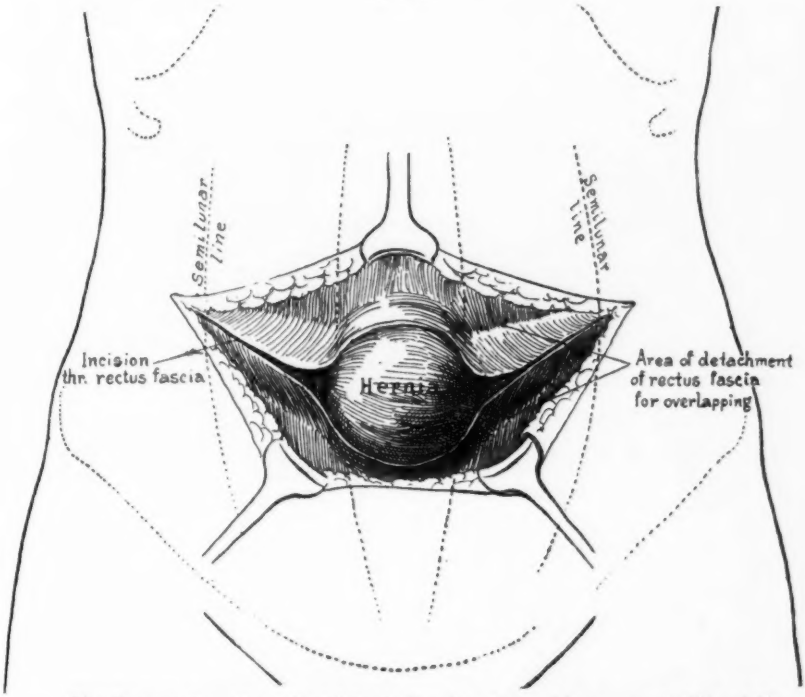
In common with most surgeons, practically all, I think, in this country, I have found that the from-above-downward overlapping operation of Drs. William and Charles Mayo, followed by suturing from side to side, is distinctly in every way the best and the most effective procedure for the treatment of an umbilical hernia, guaranteeing as a rule against recurrence. On account of the accumulated fat in the abdomen the tension is sometimes considerable, and in one of my worst cases of umbilical hernia, after a couple of years there was a relapse. For this reason in most of the subsequent cases I have adopted a more radical plan of procedure which is still based on the fundamental idea of the originators, and that is to make an incision from the right and left margins of the hernial opening all the way across and through the strong fibrous sheaths of the recti, and then to detach and raise the sheath from the recti above and below for 2 or 3 cm. The hernial sac is then freed from the rest of the tissue. It is opened and any adherent omentum present is removed. If the intestines are adherent they are carefully dissected free, and replaced in the abdominal cavity. The peritoneum is next sewn together with catgut. I next haul up and sew the free margin of the lower under the upper flap from side to side with four to six interrupted silk sutures, using, if needs be, catgut between them. If the transrectal incision is angled a little upwards and the overlapping of the recti is well done, there may be little tension; there is always a greatly diminished tension in the overlapping at the ring itself. The free overhanging margin of the upper flap is now sewed by a continuous catgut suture to the fibrous tissues and the supporting part of the operation is completed. I believe this form of closure

is a more efficient one than any yet devised. I believe too that it introduces a new principle in the strong hauling of the tissue upwards, starting well out on the sides aiding in the overlapping of the tissues at the hernial opening. I always use from four to six buried, strong silk sutures as a permanent support to hold the lower flap snugly up under the upper one;

FIG. 1.



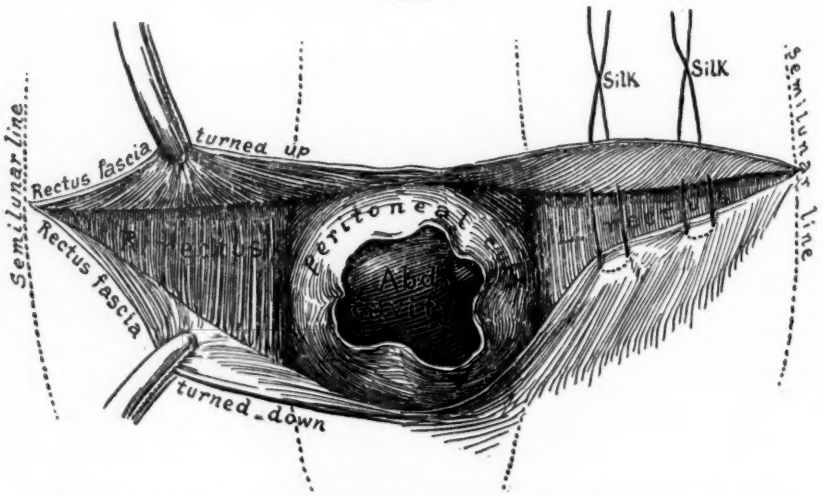
The diagram shows the patient lying in dorsal posture. A transverse incision at the level of the umbilicus has been made from outside of one semilunar line across to outside of the other semilunar line. This incision is made directly at the level of the umbilicus and extends through fat and the sheath of the rectus. The hernial sac is seen protruding between recti muscles.

all the rest of the suturing is done with catgut. I believe it will be found that this more aggressive operation while free from any added risk to life is still more effective than any as yet practiced. Dr. Charles Mayo told me in a personal communication that he has had occasion to carry his incision outward half way across the muscles.

The steps of this operation are well shown in Figs. 1, 2, and 3 accompanying this text. I usually employ horse hair

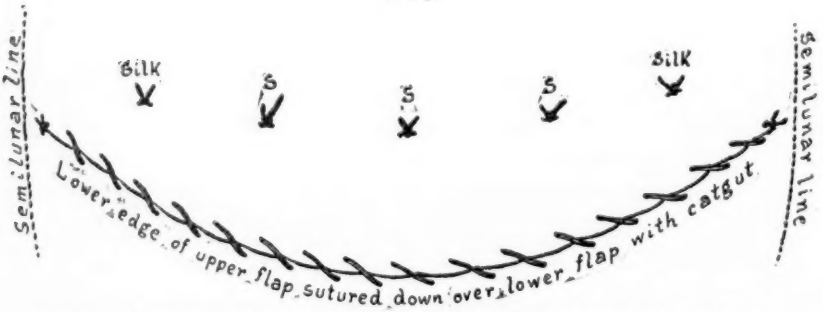
in closing the skin. This extensive operation gives no discomfort to the patient. There is no necessity for bandages or peculiar postures subsequent to the operation. The results seem to be in every way perfect and there have been no recurrences.

FIG. 2.



Shows peritoneal cavity opening, sac removed, rectus sheath dissected free, and on one side silk sutures applied.

FIG. 3.



Shows all of silk sutures tied and the lower edge of the upper flap sutured down to lower flap with catgut.

I first did this operation November 16, 1905, and have since then employed the method in seven cases. I have combined this operation in five cases with the resection of large amounts of fat from the abdominal wall, and have done it alone in three cases.

THE DIAGNOSIS OF TYPHOID PERFORATION.*

WITH REPORT OF CASES.

BY A. D. WHITING, M.D.,

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THE diagnosis of intestinal perforation during typhoid fever is, in the vast majority of instances, guesswork. Direct examination of the intestine, either on the operating table or at autopsy, alone will prove whether or not our surmise, *pro* or *con*, has been correct.

If we accept the findings of Brown (*Jour. Amer. Med. Asso.*, February 27, 1906, 695) based upon the statistics collected by Taylor, no fewer than 25,000 deaths occur annually in the United States from intestinal perforation during typhoid fever. This is in keeping with Osler's statement that one out of every three deaths during typhoid fever is due to perforation, which ratio is practically confirmed by the studies of the late J. Allison Scott (*New York Med. Jour.*, February 9, 1907, 245).

With this enormous number of perforations occurring annually one would naturally expect to find a great number of reported cases treated by operation—practically the only treatment giving any hope of recovery. Harte and Ashhurst (ANNALS OF SURGERY, January, 1904) were able to cite but 362 cases up to January, 1903, and Allaben, as quoted by Brown, could find but 162 reported operations between January, 1903, and January, 1907.

Granting that operative interference is the best treatment for typhoid perforation, this great discrepancy between the number of perforations and the number of reported operations would naturally lead one to conclude either that the estimated ratio of perforations to deaths is too high; or that it is most

* Read before the Philadelphia Academy of Surgery, February 7, 1910.

difficult to make a diagnosis of perforation; or that but few of the operated cases have been reported.

From a study of cases of typhoid perforation that have come under my observation, and of the histories of similar cases at the German Hospital, I am forced to accept all three conclusions. The records of the German Hospital from 1900 to 1909 inclusive, show that there were treated in that institution during these ten years 2053 cases of typhoid fever, of which 206, or 10 per cent., died from various causes. In 180 of the 206 deaths there was no suspicion of perforation noted. Of the remaining 26 deaths, 17 were due to perforation, found either at operation or post mortem, and in 9 cases death was due to peritonitis, probably perforative, the diagnosis not being confirmed either ante or post mortem. If all suspected cases are classed as true perforations, perforation occurred in 1.26 per cent. of all cases; if the 9 cases not confirmed are excluded, perforation occurred in .82 per cent. of the cases. This percentage is somewhat lower than that shown by statistics published by Harte and Ashhurst, who in 8881 collected cases found perforation occurring in 2.54 per cent.

The ratio of the perforative deaths to the whole number of deaths in the German Hospital series would be, with the 9 doubtful cases included, 1 in 8; without the 9 cases, about 1 in 12, a ratio considerably lower than that advanced by Osler and by Scott.

The second conclusion, that it is most difficult to make a certain diagnosis of perforation, must be concurred in by all who have studied the subject or have seen many cases. Personally, I know of no sign or symptom that is pathognomonic of perforation; I know of no train of symptoms that will lead inevitably to a diagnosis of perforation. Nor can this be considered strange, if it be realized that the patient in question is one who is suffering from an infection which makes the abdomen the site of marked intestinal disturbances and which causes a profound toxæmia to affect every organ in his body, who may exhibit abdominal pain, and rigidity, and tenderness, and distention from the onset of the infection, and who may

present all of the supposed typical signs and symptoms of perforation during the course of the fever without the occurrence of this complication.

If from 25 to 40 per cent. of the perforative cases are to be saved, a diagnosis must be made and operative interference instituted before the patient is moribund from a rapidly spreading peritonitis. This is impossible in some instances because the added burden of the calamity of perforation overwhelms all resistance that the patient may still possess. Such cases, naturally, succumb before relief can be afforded. In the majority of cases, however, the resistance of the patient will be sufficient to withstand the complication of perforation long enough to make operative interference not only advisable but mandatory.

Perforation should be suspected in every instance where the regular course of the typhoid infection in that individual case has been interrupted by some untoward mishap. Perforation should be diagnosed in all such cases, when the mishap cannot be traced directly to some complication other than perforation.

The recognition of such occurrence presupposes a thorough knowledge of the case in question obtained by painstaking and continuous study of the patient and of the various phases of the fever presenting. The possession of this knowledge by the physician in charge makes it obligatory on him to make the diagnosis and to look upon the surgeon as his mechanician rather than his consultant, unless the surgeon has studied the case with the physician before the mishap occurred. The surgeon may be able to aid the physician in determining the presence or absence of rigidity, of beginning or established peritonitis, of free fluid in the abdominal cavity; but it would be presumptuous on the part of the surgeon to attempt to recognize the occurrence of something out of the ordinary in a particular typhoid fever patient about whom he knows nothing from previous personal observation.

While it is true that this scheme of diagnosis does not take into consideration the presence or absence of any sign or

symptom or train of symptoms that may have been looked upon as indicative of perforation, it is probable that it would be productive of less harm than would waiting and searching for symptoms that may or may not appear. Mistakes would undoubtedly be made, and some patients whose condition would contraindicate operative treatment unless it were imperative would be called upon to withstand the added burden of an unnecessary operation. Were this mistake impossible under the method of diagnosing by a sign or symptom or chain of symptoms, the latter would be a better and safer scheme by which the diagnosis should be made. Unfortunately such is not the case. In the German Hospital series, two cases were operated upon in which no perforation was found. Mitchell (*Penna. Med. Jour.*, 1908) has reported a series of 93 operations for typhoid perforation, in 19 of which no perforation was found and in 7 of which no cause for the symptoms presented could be found.

If reliance is to be placed on the symptoms that may or should be present, the diagnostician very often will be led astray. Pain is probably the most constant symptom, in typical cases being sharp and stabbing, and usually localized in the right iliac fossa. In typical cases, the pain should continue for some time. In the ordinary run of cases, the pain may be such as not to cause complaint on the part of the patient; it may be entirely on the left side, in the groin, along the penis, referred to the end of the penis, in the testicle, in the epigastrium or in any other part of the abdomen. Pain may be entirely absent, or the pain complained of may be nothing more severe than a slight exacerbation of that experienced by the patient during the entire course of the disease.

Vomiting may be a symptom of perforation, or may be the cause of it. Murphy of Chicago has stated that it is constantly associated with the perforative peritonitis of typhoid. This symptom was entirely absent in a large number of the cases in the German Hospital series.

A fall of temperature may immediately follow the perforation. It was not noted in the German Hospital cases,

possibly because the temperature was not taken always at the time of perforation, but later when beginning peritonitis caused a rise rather than a fall.

Collapse and sweating are supposed to be found in connection with the fall of temperature. These are found in a fair percentage of cases, but are not present in the majority of them.

Tenderness and rigidity generally follow perforation. The former is of less value than the latter because a great many typhoid patients have abdominal tenderness throughout the entire course of the fever. Rigidity becomes more marked with spreading peritonitis, as a rule. It must be remembered in this connection that rigidity can be elicited in any case of typhoid fever, whether perforative peritonitis be present or not, by unskilled, rough palpation. The rigidity to be distinguished is that due to reflex activity of the muscles consequent upon a beginning peritonitis, obtained by the skilful touch of the artist.

As a general rule, the pulse rate increases very markedly after perforation, running as high as 140 to 160 and becoming weak and thready. In some cases no change in the pulse rate will be noted.

A change in facial expression, which Harte and Ashhurst describe as a general weakening of the expression, may be noted at the time of perforation. By the time the attention of the physician in charge has been called to the occurrence of the mishap, this cast of countenance will generally be lost, being replaced by the former expression or that more typical of general involvement of the peritoneum. In a patient profoundly toxic, no change in expression may be noted.

It was thought, at one time, that a positive diagnosis of perforation in typhoid could be based upon an increasing leucocytosis. Unfortunately, even that sign may be claimed by only a part of the cases, it being almost as variable as most of the other signs and symptoms advanced. One or two counts would be of practically no value under any conditions, unless the normal leucocyte count of that particular case had

been noted before perforation, as investigation has shown that leucopenia is not constantly associated with typhoid fever.

The two signs of perforation mentioned by Brown, namely, a "dipping crackle" elicited by a dipping palpation with the stethoscope; and the extension of tenderness in a given direction by posture of the patient, were not applied in any of the patients in this series. Whether they would be of material advantage in arriving at a correct diagnosis or not is questionable.

A brief summary of the cases in this series, details of which are appended, is as follows:

Death occurred in every case of perforation or suspected perforation where no operation was performed.

	No. of cases.
Death was due to perforation or peritonitis	26
Death was due to proved perforation	17
Death was due to possible perforation	9
Operation for perforation was performed	18
Perforations were found at operation	16
Perforations were not found at operation	2
Death followed operation for perforation	11
Recovery followed operation for perforation	7

Operative mortality was 61.1 per cent.

In conclusion I wish to thank the staff of the German Hospital for the privilege of reporting this series of cases. Most of the operations for perforation were performed by Dr. Deaver.

Following are details of cases of perforation or suspected perforation during typhoid fever occurring in the German Hospital between 1900 and 1909:

CASE I.—W.F., male aged 24; admitted April 21, 1900. Had severe pain and abdominal distention. Died from peritonitis, probably perforative. No operation. No autopsy.

CASE II.—C.K., male, aged 46; admitted August 15, 1900. Had several severe hemorrhages. Died from peritonitis. No operation. No autopsy.

CASE III.—W.J., male, aged 36; admitted March 2, 1901.

On admission abdomen was distended, there was pain and tenderness in right iliac fossa. Patient in collapse. No operation advised. Post-mortem examination, 36 hours later, showed perforation of the ileum, 4 inches from the ileocæcal junction.

CASE IV.—J.M., male, aged 28; admitted February 6, 1902, on the seventh day of typhoid. At 5.45 A.M. on the tenth day of disease, patient complained of pain in right iliac fossa, following a bowel movement. Temperature, 105°; respiration, 32; pulse, 120. There was tenderness over the right side of the abdomen, with beginning distention. At 6.20 A.M.: Temperature, 105 4/5°; respiration, 36; pulse, 136. Abdomen distended and hard. Vomiting was more or less continuous. Leucocyte count at 5.30 A.M. was 5200; at 6.30 A.M., 5600. Diagnosis: Perforation.

Operation by Dr. Deaver. Ether anæsthesia. Incision through right rectus. No escape of gas. Considerable fluid in peritoneal cavity. The appendix was retrocæcal, swollen and injected, and was removed. A large perforation in the ileum about 8 inches above the ileocæcal junction was found and closed. Drainage tube introduced into pelvis and wound closed to drainage. Patient died 24 hours after operation from exhaustion.

CASE V.—W. K., male, aged 29; admitted November 2, 1902. Case previously reported by Dr. G. G. Ross, in *Phila. Med. Jour.*, May 2, 1903.

CASE VI.—J.J., male, aged 37; admitted February 6, 1903. While at work eight days before admission, had been suddenly taken with severe chill. Went to bed where he remained three days. Then had no pain and felt well, although somewhat tired. Remained out of bed on the fifth day, but did not return to work. On the sixth day presented himself to the out-patient department for treatment. That same evening he had a sudden, sharp, burning pain in the pubic region. In two or three hours, pain was felt in the abdomen and also in the right testicle with a sensation of retraction of that organ. Pain was constant with acute exacerbations. He vomited once. Did not void urine from onset of attack of pain until admission. On admission, temperature, 101 4/5°; respiration, 40; pulse, 128. Abdomen was scaphoid, abdominal muscles tense and markedly rigid. There was marked tenderness over entire abdomen and flanks.

Percussion note was dull over abdomen from pubes to umbilicus. Marked tenderness on rectal examination. Lungs showed impaired resonance at right apex with many crepitant râles; subcrepitant râles found over entire chest anteriorly. Catheterization caused great pain; 275 c.c. urine recovered. Leucocytes numbered 17,480. Diagnosis of peritonitis made.

Operation by Dr. Deaver. Ether anæsthesia. Incision through right rectus. Free pus found. Drainage tube introduced into pelvis and wound closed to drainage. No search for cause of peritonitis. Death 22 hours after operation.

Autopsy: General purulent peritonitis, pus being general, but more plentiful in pelvis. Small intestine in pelvis covered with thick slough. Small, ragged circular perforation of ileum about 10 inches from ileocæcal junction. Three other ulcers having characteristics of typhoid were found. Spleen was greatly enlarged. Kidneys showed acute parenchymatous change. Gall-bladder negative. Mesenteric and retroperitoneal glands were enlarged. Appendix showed superficial inflammation, limited to the peritoneal coat, secondary in character.

CASE VII.—J.P., male, aged 18; admitted March 1, 1903, on the eleventh day of typhoid. General distention of abdomen; tenderness over splenic and gall-bladder regions; gurgling and tenderness in right iliac fossa.

At 5 P.M. on thirty-fourth day of disease, patient had severe pain over splenic area. Temperature, 104 1/5°. At 7 P.M. complained of pain over sternum, which gradually spread to epigastrium and then over entire abdomen. Slight rigidity of left rectus. General abdominal pain, more marked on left side. Some tenderness over gall-bladder. There was no distention, abdomen being scaphoid.

At 8 P.M., pain and tenderness became localized in right side and there was dulness in right flank. Slight rigidity of right rectus. Temperature, 103 2/5°; pulse, 120; leucocyte count, 18,800. Was transferred to surgical ward at 8.20 P.M., with diagnosis of perforation.

Operation by Dr. Whiting. Ether anæsthesia. Incision through right rectus. No escape of gas. Considerable cloudy fluid in peritoneal cavity. Appendix slightly injected; it was removed. Intestinal peritoneum was injected and red. Intestine searched for perforation but none found. Pus was found

behind liver, and more in pelvis. Gall-bladder was normal. Peritoneal cavity irrigated with saline, drainage tube introduced into pelvis and wound closed to drainage. Patient made an uneventful recovery.

CASE VIII.—W.C.W., male, aged 25; admitted March 24, 1903, on the thirteenth day of typhoid. Was profoundly toxic and ran a prolonged course of typhoid. On the forty-second day of disease, had a large hemorrhage from the bowel. On the forty-eighth day of disease, at 11 A.M., temperature, 104 4/5°; respiration, 28; pulse, 128. He was in a semi-comatose condition. At 11.55 A.M. was screaming with pain. No fall of temperature was noted. He very soon became more easy and at 12.15 P.M. had a large, formed yellow stool. He was perspiring freely. There was no vomiting. At 1 P.M. complained of severe abdominal pain. At 2 P.M., temperature, 105°; respiration, 36; pulse, 138.

Operation by Dr. Deaver, at 2.15 P.M. Ether anæsthesia. Incision through right rectus. Peritoneal cavity filled with cloudy fluid. Peritoneum deeply injected. Round perforation found 12 inches from ileocæcal junction, in ileum. Perforation closed. Appendix deeply congested; it was removed. Glass drainage placed in pelvis and wound closed to drainage. Patient died 26 hours after operation.

Autopsy revealed general peritonitis. Appendiceal and perforation wounds closed. Distal to the sutured perforation, three other perforations were found within a distance of four inches.

CASE IX.—J.C.L., male, aged 30; admitted April 24, 1903. Had had a bad diarrhœa for one week but had followed occupation of driver until 24 hours before admission. At that time had dull pain in right iliac fossa which gradually increased in severity. There was no vomiting. On admission, temperature, 102 2/5°; respiration, 46; pulse, 148. Tongue was dry, fissured and heavily coated. Pupils were dilated. Pulse rapid but of fair tension. Abdomen markedly rigid throughout. Tenderness over entire abdomen, more marked on right side. Marked tenderness on rectal examination.

Operation by Dr. Deaver. Ether anæsthesia. Incision through right rectus. Peritoneum opened allowing escape of fluid fecal matter. Peritoneum sticky, lustreless, and injected,

Numerous typhoid ulcers were seen in ileum, with perforation in base of one of them. Perforation closed. Glass drainage tube introduced into pelvis and wound closed to drainage. Patient died next day. No post-mortem examination made.

CASE X.—T.C., male, aged 31; admitted June 22, 1903. Died of peritonitis. No operation. No autopsy.

CASE XI.—A.M., male, aged 22; admitted January 13, 1903. Died of peritonitis, probably perforative. No operation. No autopsy.

CASE XII.—M.R., male, aged 14; admitted February 26, 1904, in second week of typhoid. Had been treated at home. Physician had diagnosed perforation and had sent him to hospital for operation. On admission, temperature, 98 4/5°; respiration, 24; pulse, 118. Tongue coated, red, and dry. Patient complained of pain in lower abdomen, more marked on right side. Slight abdominal distention. No mention made of vomiting.

Operation by Dr. Deaver. Ether anæsthesia. Incision through right rectus. Cloudy, straw-colored fluid in peritoneal cavity. Ileum carefully searched for perforation, but none found. Near the ileocæcal junction, in the ileum, were a number of very thin places, at which points the mucous membrane had been apparently destroyed. At several points the intestine contained clotted blood. Wound closed without drainage. Patient ran a normal course of typhoid, temperature reaching normal on eighteenth day after operation. Recovery.

CASE XIII.—S. B., female, aged 35; admitted Mar. 25, 1904, on twelfth day of typhoid. On twenty-second day of disease patient had two hemorrhages of 600 c.c. and 400 c.c., respectively, from bowel. Temperature fell from 103 4/5° to 96 3/5°. On the twenty-sixth day of disease had another hemorrhage of 250 c.c. On twenty-seventh day, at 7 P.M., complained of severe pain in region of urinary bladder. Temperature, 101°; respiration, 22; pulse, 122. At 8 P.M. had a slight chill. Temperature, 102 2/5°; respiration, 24; pulse, 144. At 12 midnight complained of severe pain in right side of abdomen. Temperature, 104°; respiration, 28; pulse, 156. Patient did not vomit.

Operation at 2.30 A.M., by Dr. Whiting. Ether anæsthesia. Incision through right rectus. Omentum found adherent to entire right iliac fossa. Omentum liberated. Two perforations, one patent, round, in centre of large necrotic area, about two

inches from ileocæcal junction. Other found at ileocæcal junction, being closed by adhesion of ileum to cæcum. Both perforations closed. Drainage tube introduced into pelvis and wound closed to drainage. Patient had a severe hemorrhage 24 hours after operation and died of exhaustion 36 hours after operation.

CASE XIV.—R.D., male, aged 43; admitted July 15, 1904, on fifteenth day of disease. On the twentieth day of disease had sudden abdominal pain at 11.30 A.M. Temperature, 101 3/5°; respiration, 26; pulse, 96. At 1.20 P.M. had a chill followed by rise of temperature to 105 2/5°; respiration, 28; pulse, 128. There was persistent vomiting and hiccough. Patient died at 10 P.M. from peritonitis, probably perforative. No operation. No autopsy.

CASE XV.—J.T., male, aged 47; admitted December 13, 1904. on twelfth day of typhoid. On the fifteenth day patient lost 800 c.c., 500 c.c., 300 c.c., and 250 c.c. of blood by bowel in successive stools. On the sixteenth day of disease a perforation of the bowel was suspected, but as the patient was practically moribund, operation was not considered. Patient died the same day. No autopsy.

CASE XVI.—J.T., male, aged 15; admitted January 30, 1905, on the ninth day of typhoid. Abdomen slightly distended, tenderness in right iliac fossa. Spleen distinctly palpable. Patient had four distinct hemorrhages on the fourteenth day of disease and another on the twentieth day. At 12 o'clock noon on the twenty-ninth day, patient had severe abdominal pain in the end of the penis. There was no shock, abdomen was soft and flat. Temperature, 103°; respiration, 26; pulse, 100. There was no vomiting. At 2 P.M. there was some rigidity of the recti, with slight tympany. Temperature, 102 3/5°; respiration, 20; pulse, 120.

Operation at 4 P.M. by Dr. Deaver. Ether anæsthesia. Incision through right rectus. Perforation of cæcum found on inner side. Perforation closed. Glass drainage in pelvis. Wound closed to drainage. Patient died at 8.35 P.M. from œdema of the lungs.

CASE XVII.—J.N., male, aged 43; admitted May 27, 1905. Six days before admission felt sharp pain in right side radiating to umbilicus, accompanied by dull headache with occasional pains shooting through head. Since onset of attack been feeling tired

out; bowels very loose, eight movements daily, watery in character. Felt somewhat better after vomiting, being relieved of abdominal pain. On admission abdomen soft, scaphoid, with no tenderness. Two days after admission experienced sudden sharp pain in general abdomen, with abrupt rise of temperature to 105 2/5°. Expulsion of large amount of flatus gave relief of all pain. Next morning pain had returned, being localized in right iliac fossa, with considerable muscular rigidity on right side. Diagnosis of acute appendicitis made and patient transferred to surgical.

Operation by Dr. Deaver. Ether anæsthesia. Incision through right rectus. Appendix congested with exudate around it. Appendix removed. Glass tube introduced into pelvis and large quantity of sero-pus removed. Appendix opened and mucous membrane found normal. Ileum searched and several typhoid ulcers found. One perforation found, fecal matter being discharged. Wound closed to drainage. Patient ran regular course of typhoid, temperature touching normal on thirteenth day after operation. Recovery.

CASE XVIII.—W.Y., male, aged 20; admitted August 25, 1905, after four weeks' illness with typhoid. Three days after admission had sharp pain in right iliac fossa, abdomen slightly distended, increasing rigidity of both recti. Face ashen hue. Pulse rose to 160. Patient died from peritonitis. No operation. No autopsy.

CASE XIX.—W.Z., male, aged 21; admission September 1, 1905. On thirty-first day of disease, had sharp pain in abdomen which awoke him from a sound sleep. Pain lasted two hours. Several points of tenderness. with very slight distention over right hypochondrium. Patient was very thirsty and had an anxious expression. On thirty-ninth day a pelvic collection was made out. Patient died on the forty-second day of the disease, from peritonitis. No mention is made of suspected perforation. No autopsy.

CASE XX.—E.M., male, aged 37; admitted November 18, 1905, with typhoid fever, complicated by pneumonia. Nine hours before death had sudden severe abdominal pain, followed by collapse. No operation. No autopsy.

CASE XXI.—J. S., male, aged 14; admitted May 2, 1906, on eleventh day of typhoid. Had considerable pain in abdomen and

gave appearance of having been a great sufferer, being markedly emaciated and having abdominal facies. Temperature, 102°; respiration, 32; pulse, 120. There was marked rigidity on right side, board-like in character. There was general tenderness. Abdomen was greatly distended. Patient died on third day after admission from peritonitis, probably perforative. No operation. No autopsy.

CASE XXII.—J.R.H., male, aged 33; admitted May 18, 1906. For two weeks before admission had suffered from general malaise, headache, anorexia, and excessive diarrhœa. Continued at work until five days before admission. On day before admission had sudden sharp pain in left groin which extended along the penis and lasted about ten minutes. Has had two similar attacks of pain since first. There was no nausea and no vomiting. On admission, temperature, 101°; respiration, 24; pulse, 100. There was general abdominal pain and tenderness, both of which were more marked in left iliac fossa. Widal was suggestive. Leucocytes, 10,400.

Operation immediately after admission by Dr. Deaver. Chloroform anæsthesia. Incision through right rectus. Large quantity of pus escaped from peritoneal cavity. Plastic exudate throughout the peritoneal cavity. Appendix congested, not removed. Superficial search made for perforation but none found. Glass drainage tube introduced into pelvis and wound closed to drainage. Patient died twenty-two hours after operation.

Autopsy: General plastic peritonitis. Intestine contained numerous typhoid ulcers, one of which had perforated about 18 inches from the ileocæcal junction.

CASE XXIII.—A.G., male, aged 26; admitted October 9, 1906, on the ninth day of typhoid. Had hemorrhages from bowel on the eleventh, fourteenth and sixteenth days of disease. At 9 A.M. on sixteenth day became very anæmic, with sighing respiration, and decided air hunger. Diagnosis of concealed hemorrhage made. Abdomen slightly tympanitic but not rigid. There was no mention by the patient of pain. Perforation was later suspected on account of rise of temperature from 102 4/5° to 107 4/5°, and rapid wiry pulse. There was a large hemorrhage from the bowel just before death.

Autopsy: Extensive ulceration in the last 18 inches of the ileum and about 8 inches of ascending colon. There was a per-

foration in the ileum 2 inches beyond the ileocæcal junction. The liver and kidneys showed acute parenchymatous change. Fecal matter was present throughout the peritoneum which was the seat of marked inflammation.

CASE XXIV.—W.S., male, aged 28; admitted December 12, 1906, with perforative peritonitis complicating typhoid fever. No operation. Died twenty-four hours after admission.

Autopsy: Perforation of ulcer of ileum, with general peritonitis.

CASE XXV.—A. F., male, aged 24; admitted December 12, 1906, with history of having had a bad cold for a week and having felt wretched. Twenty-four hours before admission had been suddenly seized with violent, sharp abdominal pain, soon followed by vomiting. Pain remained general but was more marked on right side. On admission there was marked dyspnœa, respirations rapid and labored, sputum rusty in color. Impaired resonance at right base and numerous large moist râles. Temperature, $101^{4}/_{5}°$; respiration, 36; pulse, 108. There was extreme tenderness over lower abdomen, more marked over appendix, with moderate abdominal distention. Leucocytes, 12,200. Diagnosis of acute appendicitis with pneumonia made.

Operation by Dr. Deaver: chloroform anæsthesia. Incision through right rectus with escape of pus when peritoneum was opened. Numerous adhesions near appendix. In breaking up adhesions, three pockets of pus were opened. Appendix to inner side of cæcum, removed. Glass drainage tube introduced into pelvis and considerable pus removed. Gauze drainage introduced into pelvis and to base of cæcum. Wound closed to drainage. A fecal fistula developed immediately after operation, which persisted for about two weeks, finally closing without operation. Nine days after operation, rose spots appeared on abdomen and a positive Widal was obtained. The patient ran a regular course of typhoid and recovered.

CASE XXVI.—L. S., male, aged 31; admitted April 8, 1907. On seventh day after admission patient had attack of severe abdominal pain in lower right quadrant with rigidity of right rectus, followed by free bowel movement. Leucocyte counts: 2 A.M., 5200; 4.30 A.M., 10,500; 6.45 A.M., 12,700; 8.15 A.M., 6400, a second count at this time giving 7100. There was no vomiting. At 2.30 A.M. patient had a large bowel movement with hemorrhage.

Operation at 11 A.M., by Dr. Whiting: ether anæsthesia. Incision through right rectus. Considerable free pus and fecal matter in peritoneal cavity. Perforation found 6 inches from the ileocæcal junction, in the ileum. Drainage tube introduced into pelvis and large amount of pus and fecal matter evacuated. Wound closed to drainage. Patient died next day. No autopsy.

CASE XXVII.—S. S., female, aged 20; admitted May 8, 1907, on fourteenth day of typhoid. On twenty-second day of disease, patient had hemorrhage from the bowel. At 11 P.M. on the twenty-fourth day, patient complained of pain in the abdomen, which was entirely relieved by catheterization. Temperature, $103^{1}/_{5}°$; respiration, 20; pulse, 124. At 8.30 A.M. on the twenty-fifth day, patient had severe pain in abdomen, more marked in lower right quadrant. Pulse became weak and running, respiration being sighing in character. Patient vomited. There was some general abdominal tenderness and slight rigidity of the right rectus. Liver dulness was not impaired. A diagnosis of perforation was made, but owing to a difference of opinion among the consultants no operation was performed. Patient died on the twenty-eighth day of disease from general peritonitis.

Autopsy: General peritonitis due to perforation of the ileum about 5 inches from the ileocæcal junction.

CASE XXVIII.—W. P., male, aged 19; admitted October 21, 1907. Had been treated at home for typhoid. On the morning of admission had had an attack of excruciating pain in the abdomen followed by very rapid pulse. No mention made of vomiting. Diagnosis of perforation made and patient sent to hospital for operation. On admission, temperature, $103^{3}/_{5}°$; respiration, 28; pulse, 124. Leucocytes numbered 10,300. The abdomen was retracted. There was no localized rigidity although there was a suggestion of greater firmness over right iliac fossa. Slight tenderness in right iliac fossa.

Operation by Dr. Deaver: ether anæsthesia. Incision through right rectus. Free air, fecal matter and pus found in peritoneal cavity. Perforation of ileum about 10 inches from ileocæcal junction was found and closed. Glass drainage tube introduced into pelvis and wound closed to drainage. Patient continued regular course of typhoid, the temperature reaching normal on the twelfth day after operation. Recovery.

CASE XXIX.—H. G. K., male, aged 17; admitted January 28, 1908, in second week of relapse of typhoid, with history of having had a perforation the day before. Patient taken from ambulance to operating room. General distention of abdomen, with rigidity and tenderness.

Operation by Dr. Deaver: ether anæsthesia. Incision through right rectus. Free pus and fecal matter found. Intestine injected and covered with exudate. Perforation found in ileum 18 inches from ileocæcal junction. Perforation closed. Glass drainage tube introduced into pelvis and wound closed to drainage. Patient died on third day after operation from peritonitis. No autopsy.

CASE XXX.—T. S., male, aged 17; admitted February 11, 1908, on fourteenth day of typhoid. Abdomen was somewhat full but soft. On thirty-second day of disease had severe abdominal pain, being found writhing with pain at 11.45 P.M. At 12 o'clock midnight, temperature, 103 4/5°; respiration, 24; pulse, 104. The attack of pain was followed by a large bowel movement. Leucocyte counts: 11.45 P.M., 5600; 12.45 P.M., 5700; 2.45 A.M., 5200; 11 A.M., 5300. No changes were noted in pulse or temperature and for four days the patient was distinctly better in every way.

On the thirty-sixth day the abdomen became suddenly distended, the liver dulness being absolutely obliterated. Three different leucocyte counts gave 7500, 7400, and 7300 respectively. Patient died on the thirty-seventh day.

Autopsy: There was general peritonitis due to an old perforation which had taken place in the ileum about 12 inches from the ileocæcal junction, surrounded by dense adhesions which had formed a wall of an abscess. This had ruptured and caused the general peritonitis. In this case there were no symptoms of perforation except the initial pain.

CASE XXXI.—T. B., male, aged 24; admitted April 17, 1908, on the eleventh day of typhoid. On admission the abdomen was soft but showed general tenderness. Liver and spleen were not palpable. At 12 o'clock noon on the sixteenth day of disease, patient had a severe abdominal pain, followed by rigidity of the recti and some distention of the abdomen. Patient complained of frequent desire for stool and micturition. Temperature, 102°; respiration, 28; pulse, 92. At 2 P.M., patient had a large stool

followed by another attack of severe abdominal pain. Temperature, 105 1/5°; respiration, 40; pulse, 112. Patient did not vomit. Rigidity of right rectus with distention.

Operation at 4 P.M., by Dr. Deaver: ether anæsthesia. Incision through right rectus. Slight amount of free fluid in abdominal cavity. Appendix examined and found normal. A perforation the size of a pinhead was found in the ileum about 8 inches from the ileocæcal junction. Ulcer bearing area invaginated. Glass drainage tube introduced into pelvis and wound closed to drainage. Patient ran a regular course of typhoid and recovered.

CASE XXXII.—M. W., female, aged 18; admitted December 25, 1908. History of having been sick for eight days before admission. Apathetic: tongue heavily coated; sordes on lips; heart rapid; spleen enlarged. Abdomen generally tender with some distention. Musical râles at left base on deep inspiration. Pulse, 148. Ran regular course until January 20, 1909, when complained of severe cramp-like pain in lower abdomen, at 10.45 A.M. At 12 noon liver dulness extended to costal margin; there was no tympany. Slight tenderness over McBurney's point. Continuous chill and shaking. Cyanosis. Considered at this time possible perforation. Leucocytes, 10,800. At 1 P.M., given hot-water bags to extremities and ice bags to abdomen. Color good; temperature gradually rising. No abdominal tenderness, nor rigidity. At 3 P.M., leucocytes, 8600. Complained of weight of ice bag. No rigidity, liver dulness not diminished. At 4 P.M., some slight abdominal distention, liver dulness replaced by tympany. Very slight rigidity. Has felt nauseated once but has not vomited. At 7 P.M., consultation and operation advised.

Operation by Dr. Whiting: ether anæsthesia. Incision through right rectus. Beginning peritonitis with free fecal matter in cavity. Perforation found in ileum 8 inches from ileocæcal junction, with several ulcerating areas in adjacent portion. Perforation closed and one ulcer-bearing area invaginated. Glass drainage tube introduced into pelvis and wound closed to drainage. Culture from peritoneal cavity showed pure growth of colon bacillus. Patient ran regular course of typhoid and made a good recovery.

CASE XXXIII.—E. I., female, aged 54; admitted June 14, 1909, on the seventh day of typhoid. On admission, temperature,

104 1/5°; respiration, 44; pulse, 116. The abdomen was considerably distended and somewhat tense. Spleen not palpable. The distention continued increasing, becoming drum-like. There was persistent vomiting. Peritonitis from perforation was diagnosed but it was not considered advisable to operate on account of unfavorable condition of patient. Died twenty-six hours after admission.

Autopsy: Bronchopneumonia of both lungs. Enormous distention of peritoneal *cavity* by gas, with some free fecal matter. The intestine was flat, being matted against the posterior wall of the abdomen. Typhoid ulcers of the ileum and cæcum were present, with four perforations in the cæcum. There was also focal necrosis of the liver.

TREATMENT OF CHRONIC TUBERCULOUS SINUSES BY BECK'S BISMUTH-VASELINE PASTE INJECTIONS.*

BY JOHN B. SHOBER, M.D.,

OF PHILADELPHIA.

Dr. Emil G. Beck of Chicago published in the *Illinois Medical Journal,* April, 1908, a paper entitled, "A New Method of Diagnosis and Treatment of Fistulous Tracts, Tuberculous Sinuses and Abscess Cavities," and at the Sixth International Congress on Tuberculosis, held at Washington, D. C., September 28 to October 5, 1908, he presented another paper entitled, "The Surgical Treatment of Tuberculous Sinuses and Their Prevention."

In order to diagnose the extent and ramifications of chronic tubercular sinuses, with a view of determining the advisability of surgical operation, Dr. Beck injected a number of cases with a paste composed of one part bismuth and two parts vaseline and then had radiographs made. The pictures clearly showed the extent of the fistulous network in the cases and explained the reason of failure in several previous operations. They also demonstrated the uselessness of an operation which does not reach every part of the diseased tract. On the other hand, by the use of bismuth radiographs as a guide in reaching the entire seat of disease, several successful operations were performed. This announcement alone would have been sufficient to attract the attention of the profession, and in the future the method will doubtless be universally used before undertaking surgical operations in these cases.

But this was not all. The first case injected for diagnostic purposes led to a most important discovery, namely, that the

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* Read before the Philadelphia Academy of Surgery, February 7, 1910.

injection of liquefied bismuth-vaseline paste is not only valuable for diagnostic purposes, but for curative purposes as well. It disclosed a new method of treatment. In his first paper Dr. Beck says that after one single injection of the bismuth paste a fistula following a psoas abscess, which had existed nearly two years, entirely closed and has remained so up to date. Other cases were subjected to the same treatment with similar results. In his paper read before the International Congress on Tuberculosis Dr. Beck reported 192 cases treated by the bismuth-vaseline paste method, of which 64 per cent. were healed, 28½ per cent. improved, 6 per cent. unchanged, and 1½ per cent. died during the period of treatment or after. A large variety of cases were treated, including osteomyelitis of long bones with sinuses, empyema and tuberculous lung abscesses, suppurative sinuses of the head, sinuses following tuberculous glands, rectal fistulæ, and tuberculosis of the kidney with sinuses.

Impressed by Dr. Beck's first paper, I determined to try the method when occasion should arise. My personal experience has been confined to only five cases, but I have advised this method in consultation in a number of cases where the results have been equally gratifying.

My cases comprise 2 psoas abscess sinuses of five and three year' duration, 2 cases of tuberculous hip joint with sinuses of two and three years' duration, in which one had been operated on twice and the other once, and one case of tuberculous sacro-iliac synchondrosis with sinuses of one and a half years' duration.

Case I.—Referred to me by Dr. F. Fremont-Smith in August, 1907, in Bar Harbor, Me. A woman of 35 years, from whom I had removed a tuberculous right kidney in October, 1907, and the pelvic organs in December, 1907.* A persistent sinus existed from an old psoas abscess which was opened in 1902. No attempt was made to treat the sinus at the time of my operations. During the five years the sinus had existed it would frequently close,

* This case was reported in the *Therapeutic Gazette*, June 15, 1908, in a paper entitled "Nephroureterectomy for Tuberculosis."

causing great pain and requiring reopening which was always followed by a large discharge of pus.

In the summer of 1907 I diagnosed a tuberculous right kidney and proposed operation, which she accepted and went with me to Philadelphia. I removed a large tuberculous kidney and ureter and a month or so later was obliged to do a bilateral salpingohysteromyomectomy for symptoms which made me suspect tuberculous disease of these organs. I found chronic pelvic inflammatory disease and a fibrous uterus. The patient returned to Bar Harbor that winter, rapidly gained health and strength and began to earn her own living. The psoas abscess sinus, however, persisted, and upon my return to Bar Harbor in June, 1908, I proposed treatment with Beck's bismuth-vaseline paste.

The opening of the sinus was just above the middle of Poupart's ligament, on the right side. Between June 25 and October 24 she had 12 injections. From the time of the first injection the character of the discharge changed from a characteristic irritating purulent discharge to a mild, thin mucopurulent discharge, and it rapidly grew less in quantity. At first I was able to inject about 3 drachms of the paste and finally not more than 30 or 40 minims, until, at last, on September 24, it had closed completely and has remained so to present date. Before her operation in October, 1907, her weight was 117 pounds. In June, 1908, when I began treating the sinus, she weighed 142 pounds. During the summer and autumn she gained 10½ pounds. I made two radiographs during the course of injections. The first shows a single tract sinus extending to and pocketing around the base of the third lumbar vertebra, and the second a month later showing the same sinus but much narrower than at first, and the third a very narrow streak of bismuth along the tract but a pocket of paste on the left side of the body of the vertebra.

This was a very instructive case and the lesson I learned from it was that I made a mistake in attempting to keep the paste in the sinus after injection, by plugging the mouth of it with guaze and strapping it down. Dr. Beck has also come to the conclusion that better results are obtained by allowing the paste to escape into the dressing. I believe that fewer injections would have been required had I done so.

CASE II.—A similar case of psoas abscess sinus in a man of 27 years which had persisted for three years. The radiograph showed a straight tract to the third lumbar vetrebra with a small pocket over the middle of its base. There were two bulging places and a widened place along the course of the tract. In this case I allowed the paste to drain into the dressings and noted that only a fraction of it escaped each time. After the fifth injection the sinus closed permanently. This case was treated in January, 1909, and has remained healed.

CASE III.—Referred to me by Dr. F. Fremont-Smith of Bar Harbor, Me. The man was an expert blacksmith, 32 years old, employed in a large buckboard factory. He had first consulted Dr. Smith three years previously for bilateral, very much enlarged cervical and axillary glands suggesting Hodgkin's disease. After careful study the condition was considered tuberculous. Subsequently several of the glandular swellings were incised but no distinct abscess cavities were found. For two years he led an out-of-door life and was placed on a carefully regulated hygienic, dietetic and tonic course of treatment and for a long time took regulated doses of arsenauro with the result that all the swellings entirely disappeared and he returned to work. One year before he was referred to me, which was in July, 1908, he began to suffer pain in the left hip on exertion. In December, 1907, a swelling appeared over the lower spine and sacrum. It increased slowly for four months and then the abscess opened spontaneously. It was a diffuse swelling, the size of two hands. There was one large bunch on the left side of median line and two smaller ones on the right side. A large quantity of pus escaped and one sinus on the left side immediately above the sacro-iliac synchondrosis had persisted, discharging pus freely and requiring two or more changes of dressing daily. I had this pus examined bacteriologically and tubercle bacilli were found. Injection of the pus into guinea pigs also gave positive results. Upon examination I found a small sinus opening to left of the median line one inch above the sacrum, and in a similar position on the right side there was a small red area, almost ready to open spontaneously, which gave a sense of fluctuation. Pressure over this area and also to the left and below the sinus caused a discharge of pus from it.

I gave him the first injection on July 10, 1908, and was able

to introduce easily one ounce of the paste which caused a well marked bulging on both sides of the sacrum immediately below the opening of the sinus and also a smaller bulging below the red spot above referred to. There was distinct improvement in the character and amount of discharge from the first, and after the fifth injection there was very little purulent discharge all summer. As time went on I was able to introduce less and less of the paste. On August 22, after the twelfth injection, it was noted that there had been only very slight, thin, translucent, brownish stained serum for a long time. At this time the cavities took only one-half ounce of the paste. There was a general feeling of firmness in and around the cavities on both sides. The rounded, firmly elastic bunch on the left side felt firmer. The skin moved freely over it. On the left side the injection caused no bunching and the tissues around this area felt firm and contracted. At the time of the twenty-first injection, on October 2, 1908, I could introduce only 1½ drachms of the paste. There had been no discharge for several weeks. The patient had gained weight and strength and resumed his occupation. Through the greater part of the autumn and winter the sinus continued to discharge daily a very small amount of a thin cloudy serum, when suddenly one day there was quite a large discharge which he described as pus. He then consulted Dr. G. R. Higgins in whose care I had left him on my return to Philadelphia. Dr. Higgins gave him a few injections of the paste, and then upon the patient's request wrote to Dr. Beck and sent him to Chicago. He remained in Dr. Beck's hospital only a few weeks, where he received a few more injections with some improvement and was promised a cure. He, however, decided to return home when he continued to improve. When I returned to Bar Harbor in June, 1909, I found the sinus almost closed and was able to inject only a few minims of the paste. The area around the opposite red spot, however, was slightly soft and fluctuating. I opened it and squeezed out a few minims of occluded paste. The tissues below and around the old cavity areas were firm and contracted. The wound I made soon healed. I cauterized the opening of the old sinus which promptly closed and there has been no sign of trouble since. I believe the discharge he had in the winter was not pus but the remains of occluded paste, and this illustrates the wisdom of favoring the

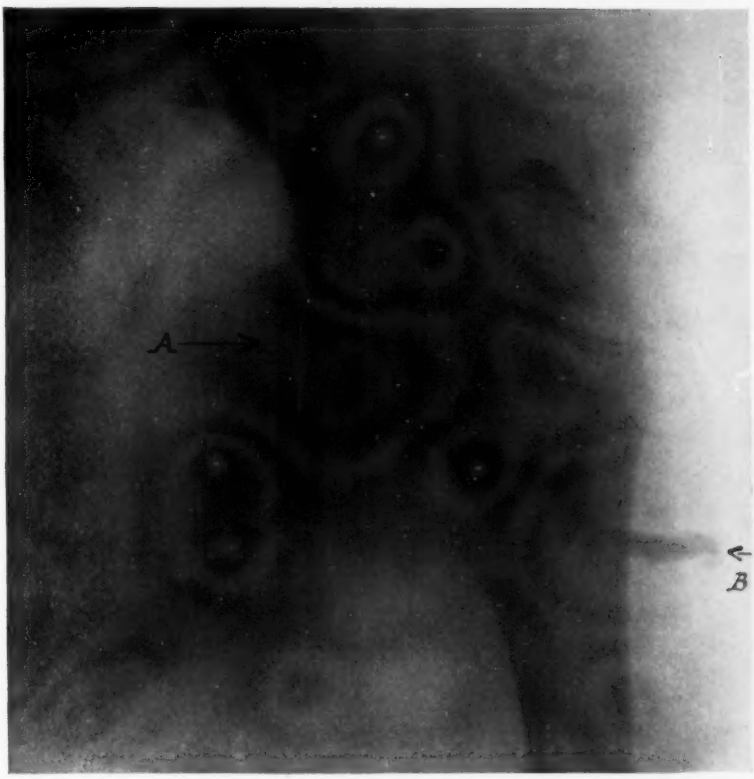
escape of paste in such cases. It probably acts as an irritant if allowed to remain any length of time.

CASE IV.—Tuberculous hip-joint disease with persisting sinus on outer aspect of left thigh of three years' duration, in a little girl of 8 years who had had two radical operations. This case was referred to me December 16, 1908. The radiograph showed a network of sinuses around the ankylosed joint and extending on to the sacrum and marked destruction of bone tissue and absorption around the head of the femur and the acetabulum. This case was given nine injections at intervals of four to seven days. She discarded her crutches after the third injection, her general health improved and she gained rapidly in weight. The sinus had closed February 8 and remained so until a short time ago. In August I received a letter from her mother stating the child had been feeling badly for a few weeks and the sinus had opened, discharging some of the paste and a small quantity of pus. She had two injections in December, 1909, and the sinuses now appear to be permanently closed.

CASE V.—Tuberculous disease of hip-joint in a boy of 7 years, referred to me by Dr. F. L. Ober of North East Harbor, Me., on July 19, 1909, for a bismuth-vaseline radiograph for diagnostic purposes. There were two sinuses, one in the groin and the other posteriorly about two inches above the great trochanter. I injected both these sinuses under firm pressure and made the radiograph which I herewith present for your inspection (Fig. 1). It is very like the picture of the previous case and shows extensive disease around the head of the bone. In a letter dated September 9, 1909, the father says that the boy went to the Maine General Hospital in Portland in September, 1904, and the following year he was operated upon in the Bar Harbor Hospital. The wound has never healed properly and has been discharging more or less ever since. In 1906, another place was opened which has also not entirely healed. Since the injection of the paste there has been very little discharge of pus, only a slight moisture around the sinuses. His health has improved and he seems to be gaining weight and has given up the use of his crutches.

The technic and rules to be observed in making these injections are very simple. The paste consists of bismuth subni-

FIG. 1.



Case V.—*A*, Anterior fistulous opening. *B*, Posterior fistulous opening.

trate 33 per cent. and vaseline 67 per cent. The bismuth should be slowly stirred into the vaseline while hot, but not boiling. When cool this mixture forms a thick soft paste. Just before using, it should be heated and thoroughly stirred until it becomes thin enough to be drawn into a suitable syringe. Dr. Beck recommends a syringe which I show you. Care should be taken that no water should enter the sinus, which requires no treatment other than washing its orifice with 95 per cent. alcohol. It is not necessary to dry out the sinus with gauze. The nozzle of the syringe should be placed firmly against the opening and under moderate pressure the paste is slowly forced in until the patient begins to complain. A pledget of gauze is then placed against the opening and an ice bag applied for a short time. The patient should remain quiet for a few hours. An anæsthetic is not required as the injections are usually painless.

Various theories have been advanced to explain the results which follow this method. Beck believes that the action of bismuth subnitrate is bactericidal, chemotactic and astringent, and says that he investigated its bactericidal action by systematic examination of the secretions from suppurating sinuses while under treatment and invariably found a continuous decrease in the number of organisms and in many cases their final disappearance. Tubercle bacilli were no exception to the rule. He goes on to say: "Whether the bismuth destroys the bacilli by its chemical action or whether its presence acts as a chemotactic, we have not yet determined, although the evidence predominates that its chemotactic property accounts for the destruction of the micro-organisms." He also believes that the mechanical action of the bismuth paste is a prominent factor in the healing process. The diseased walls are separated, bringing them in contact with a substance in itself bactericidal and stimulating. Another factor is the well-known influence of the X-rays upon tuberculous disease in the presence of bismuth vaseline, but he admits that it can play only a secondary part in the healing, since excellent results have been obtained without the aid of the X-rays.

For obvious reasons this method is not applicable in cases of biliary or pancreatic fistulæ or in sinuses communicating with the cranial cavity or hollow viscera. There are cases in which the bismuth plug may by pressure on a vital organ produce unpleasant symptoms. Neighboring large veins may be so altered by the suppurative process as to permit the injection to break through the thin and diseased wall, and in this way enter the circulation, causing serious consequences. By animal experiments he demonstrated that the bismuth paste injected into the axilla caused death within two minutes, due to the entrance of the paste into the axillary vein, and finally blocking the branches of the pulmonary artery.

Toxic effects from the use of large quantities of the paste have been observed in a few cases. The symptoms are those of nitrite poisoning so well known to the röntgenologist in the early work of bismuth feeding and injections for diagnostic purposes. When used with a moderate degree of caution there is no danger. Injections up to 100 Grams of the 33 per cent. paste produce no toxic effect.

Among the important conclusions with which Beck closes his paper are the following: Tuberculous sinuses, fistulous tracts, abscess cavities, including empyema, can be cured by injecting them with a 33 per cent. bismuth-vaseline paste. The formation of sinuses and fistulous tracts may be prevented by opening cold abscesses, evacuating the fluid, and at once injecting a quantity (not exceeding 300 Grams) of 10 per cent. bismuth-vaseline paste and not sealing the opening. While these injections are effective in all suppurative sinuses and cavities, those of tuberculous origin respond to them more readily. This method of treatment is applicable to the suppurative accessory sinuses of the head.

TRANSACTIONS
OF THE
NEW YORK SURGICAL SOCIETY.

Stated Meeting, January 12, 1910,

The President, Dr. Ellsworth Eliot, Jr., in the Chair.

NEPHROLITHIASIS.

Dr. Alexander B. Johnson presented a boy of thirteen years of age who was admitted to the New York Hospital on November 9, 1909, complaining of a dull pain in the right lumbar region, the first symptoms having been observed five days prior to his admission. The onset of the pain was gradual; it was intermittent and dull in character, and localized in the right lumbar region. Both the patient and his mother had noticed blood in his urine on several occasions. There were no disturbances of the general health, nor had there been any subjective urinary symptoms. There was tenderness on deep pressure over the right kidney in front, and tenderness posteriorly on percussion over the twelfth rib. An X-ray picture showed a small but distinct shadow corresponding to the situation of the pelvis of the right kidney.

Operation (November 11, 1909).—An incision parallel to the ribs upon the right side exposed a kidney normal in appearance and consistence. Palpation showed the presence of a stone, well outside the kidney, at the junction of the pelvis with the ureter. The stone could be readily grasped between the fingers, and it was the intention of the operator to incise the pelvis over the stone. In order to bring the pelvis into view the kidney was separated from its fatty capsule and drawn into the wound. When this was done and the stone was again sought for by palpation, it could no longer be found, even after manipulation of the kidney. Sure of its presence, however, Dr. Johnson finally incised the kidney through its convex border and searched the

pelvis and calices with blunt instruments, without result, and it was only after inserting his right forefinger into the pelvis and calices that he finally felt the stone, which lay hidden in the uppermost calyx, whence the tip of the finger readily extracted it.

This case, Dr. Johnson said, illustrated how easily a small stone might be missed. In this instance, while the stone was hidden within the sinus of the kidney, neither external palpation of the organ nor exploration of the pelvis with instruments detected its presence, and had he not been certain that it was there, he might have desisted from further search.

The wound in the kidney was closed by suture, and the external wound was also closed excepting for a small drainage opening at its posterior angle. The drain was removed at the end of the fifth day. The boy made an uninterrupted convalescence, and left the hospital on November 27, 1909.

Dr. Johnson also presented a woman, 50 years old, who was admitted to the New York Hospital July 28, 1909. For a long time she had complained of more or less pain and discomfort in the left lumbar region, for the relief of which she had been variously treated. Nine months ago Alexander's operation upon the round ligaments was done, but without benefit. For the past year she had suffered from loss of flesh and strength, headache, and general impairment of health. She had never noticed blood in the urine. During the preceding three weeks her condition had been noticeably worse; she had suffered from continuous pain, which was localized in the left lumbar region, and from frequent urination. The pain had been worse during the day time.

Examination showed that the left kidney was distinctly enlarged, readily palpable and tender. The right kidney was slightly tender, but no enlargement could be detected. A cystoscopic examination, made by Dr. Alfred Taylor, showed a general cystitis. The mouth of the right ureter was normal; that of the left was inflamed and slightly protruding. On agar culture, urine from the left ureter gave a pure growth of colon bacilli, while a culture from the urine on the opposite side remained sterile. An X-ray examination showed a distinct shadow in the region of the right kidney, which seemed undoubtedly to be due to the presence of a large stone. On the other hand, no definite shadow could be recognized indicating the presence of a stone

in the left kidney. The entire left kidney region, however, as shadowed upon the negative, seemed slightly lighter than normal.

As the rational symptoms and physical signs pointed very definitely to serious trouble in the left kidney, that organ was exposed on August 6, 1909, through an incision parallel to the ribs. The kidney was found to be much enlarged, with a knobby and uneven surface, and as hard as a brick. It seemed to consist of a large mass of calculi held together by the remains of an almost totally disintegrated kidney. After removal of the organ. the stones were found to consist of soft friable masses of urates and phosphates, together with numerous hard irregular calculi which filled the dilated pelvis and calices.

The pathological report upon the kidney after the removal of the stones was as follows: The kidney was enlarged, and its calices markedly dilated and lined with a granular soft membrane. The cortex was partially destroyed. Microscopically, the examination showed the lesion of acute pyelonephritis. There were no evidences of tuberculosis.

The patient made an uneventful convalescence, and subsequent to the operation she continued to pass abundant urine. Some weeks after the operation she began to suffer from very severe pain in the left loin. This pain was so severe that it gave rise to some anxiety, and for a number of days no local cause for it could be discovered until the outbreak of an eruption having the characteristics of herpes zoster. Since then her general health had improved, and she had at present no symptoms referable to the urinary tract. The stone or stones in her remaining kidney were quiescent.

Dr. John F. Erdman, speaking of the first case shown by Dr. Johnson, said he had seen four cases of calculus of the kidney or ureter in children under fifteen years of age during the past eight or nine months. The youngest of these was a child of five years in whom he removed a calculus from the ureter; in the other cases, the stone was found in the kidney. One of the cases had been operated on for appendicitis about a year ago, but the pain that led to that operation was not relieved until the removal of the renal stone.

Referring to the difficulty of locating the stone in some of these cases, Dr. Erdmann said that in a case seen at Yonkers a

few months ago the X-ray showed a very distinct outline of the calculus, but upon exposure of the kidney he could not find it. Upon incising the kidney, he finally succeeded in locating the stone, which was fully half an inch in diameter, but flattened, and lying in such a position that it could not be palpated.

Dr. Erdmann presented a number of calculi which he had removed from the kidney of a boy, fifteen years old. This patient had been operated on a year before for suspected appendicitis. The urine contained a small amount of pus. The affected kidney was much enlarged, and on opening the loin and incising the kidney, fully a quart of pus and five calculi were evacuated. The kidney was removed as apparently no healthy structure remained.

Dr. Johnson, in reply to a question as to the frequency of kidney stones in early life, said he thought such cases were comparatively rare. He could recall perhaps five cases in children under fifteen years of age. He further said that he had seen quite a number of cases where patients were treated for long periods of time for supposed stomach or intestinal trouble, and whose real trouble was renal calculus. In some of these cases the pain was referred to the anterior abdomen rather than to the back.

Dr. Ellsworth Eliot said that in some cases of renal stone, instead of the usual pain in the lumbar region, which was a very constant symptom, the pain was referred to the anterior abdominal wall. The speaker said he had seen one such case.

Dr. Erdmann said he had reported one case of renal calculus together with several cases of ureteral stones in which the symptoms of the patients led to operations for appendicitis before the actual cause of the trouble was discovered.

EPITHELIOMA OF THE SCALP.

Dr. William Darrach presented a widow, eighty years old, who was admitted to Dr. Brewer's service at Roosevelt Hospital in November, 1909. The history obtained was that many years ago she noticed a small lump over the occipital region in the midline. This grew very slowly until about six years ago, when its growth became more rapid. Excepting for the weight and discomfort caused by the growth, there had been no symptoms.

On examination, there was a large, cauliflower-like mass

situated over the occipital region, with a base about 3½ inches in diameter. It was pedunculated and lobular, and slightly movable upon the underlying bone.

A section removed for microscopic purposes showed it to be an epithelioma. At first it was deemed advisable not to operate, because of the patient's age and enfeebled condition, but after she had had several quite severe hemorrhages from the surface of the mass, it was decided to remove it to save her life.

On December 2, 1909, after a preliminary hypodermic of one-sixth of a grain of morphine, the mass was encircled by a ring of injections of a 1 per cent. cocaine solution. A chain-stitch of heavy chromic gut, with a needle at each end, was then passed along this line, which was three-quarters of an inch from the base of the tumor. The mass was then rapidly excised. The excessive bleeding was controlled by pressure until the vessels could be clamped and tied.

At the completion of the operation, the patient's pulse had risen to 150 per minute and was scarcely perceptible, but after a few hours she rallied and had had no untoward symptoms since. The occipital bone was left bare over an area two inches in diameter, but this became entirely covered by granulations, and skin grafts were applied on January 8 of the present year. For two days prior to the grafting the wound was poulticed, and then a wet dressing of glycerine was applied for eight hours before the operation. The grafts were cut and placed dry and no dressing was applied.

The pathological report, made by Dr. William C. Clarke, was as follows: The tumor mass measured 10 x 14 x 20 cm., and weighed 1008 Gm. It was divided into lobules and attached to the scalp. The base of the tumor was smaller than the tumor as a whole, and did not infiltrate the deeper tissues. Its surface was covered with skin excepting at several points, where it was excoriated. Cut sections showed the tissue as a whole to be firm and homogeneous, and divided into small lobules by thin connective-tissue septa. In one of the lobules there were a few small cysts filled with turbid fluid. Microscopically, alveoli of squamous epithelium made up the tumor. These alveoli had a very distinct outline, the cells not infiltrating the connective-tissue septa. The smaller cysts were enclosed by living cells, and were not formed by degeneration or necrosis.

GASTRO-ENTEROSTOMY UNDER LOCAL ANÆSTHESIA.

Dr. Eugene H. Pool presented a man, forty-three years old, whose history dated back to August 15, 1909, when he complained of discomfort in the epigastrium some time after eating, with poor appetite and constipation. Soon afterwards, he began to vomit almost daily, the vomitus containing, apparently, everything he had eaten, but no blood. He stated that he had lost 25 pounds in weight by October 14, when he entered the Presbyterian Hospital, where he remained until November 2 under the care of Dr. W. Gilman Thompson, by whose permission the following extracts from the records of the case were made: The patient was anæmic and emaciated and looked chronically ill. The abdomen was distended, and the stomach much dilated. Test meal showed the presence of lactic acid. There was no hydrochloric acid; no blood. Lavage removed enormous quantities of undigested food. On inflation of the stomach, its lower curvature was found in the median line, two and six-eighths inches below the umbilicus. Diagnosis—dilatation of the stomach and pyloric obstruction.

The patient continued vomiting, and his weight, which on admission was 95 pounds, was decreasing. Medical treatment seemed to have accomplished nothing, and an operation was advised, but refused by the patient. He left the Presbyterian Hospital and about two weeks later entered the French Hospital, where Dr. Pool first saw him. On admission, his weight was 84 pounds. The clinical features of the case, as well as the result of the gastric analysis were about the same as given above, but the patient's general condition had grown progressively worse. On November 10 his pulse-rate was 140; the radial pulse was imperceptible. An examination of the chest showed signs suspicious of tuberculosis in the right apex, and the von Pirquet test gave a positive reaction. After resting for nine days, much of the time in the open air, with nutritive enemata, lavage, etc., his general condition had slightly improved, and an operation, which had hitherto seemed inadvisable, was undertaken. Under local anæsthesia (novocain) the abdomen was opened. The stomach was found to be much enlarged, and palpation of the organ with the flat of the hand in the peritoneal cavity failed to reveal thickening of its wall at any place. The

lumen of the pylorus could not be tested with the finger on account of pain on manipulation. It was not deemed advisable to prolong the examination, although the cause of the dilatation of the stomach was not definitely ascertained. A posterior gastro-enterostomy by suture was done by the no-loop method.

In returning the stomach and intestines to the abdomen, the fingers were inserted to lift the edges of the wound, and pressure upon the parietal peritoneum gave rise to some pain. A few whiffs of chloroform were given during the closure of the wound. Otherwise, the local anæsthetic was entirely satisfactory, as there was no omental distress and the patient complained of pain only twice during the course of the operation.

Since the operation the man had had a good appetite and had gained fourteen pounds in weight. He had not vomited since, and had been relatively free from discomfort.

PERINEAL ECTOPIA TESTIS WITH HERNIAL SAC.

Dr. Clarence A. McWilliams presented a boy of fifteen years who was admitted to the Presbyterian Hospital on October 26, 1909, in the service of Dr. Joseph A. Blake. The history he gave was that for about two years he had suffered from pains under the left side of the scrotum when exercising, and of sensitiveness in that region produced by the pressure of his clothing.

Examination (Fig. 1) showed that the left side of the scrotum was devoid of a testicle, and was rather tightly drawn over the right testis, which itself was of normal size and in normal position. Just behind the left side of the scrotum in the perineum there was situated an elongated, pear-shaped body, with its long axis directed towards the external ring, and in size about half that of the normal testis. This body possessed testicular sensation. There was no evidence of a hernia visible nor palpable, nor was there any history of such.

An incision was made as for hernia and carried down over the swelling into the perineum. On cutting through the fascia below the external ring, a rather superficially placed hernial sac was opened, having no contents. Projecting into this sac on its posterior aspect were the elements of the cord and the testis itself. On passing the finger down the sac and beyond the testis, the lower extremity of the sac was reached one inch in front of the anus. The sac, with the testis and cord, was freed up to the

internal ring after splitting the external oblique muscle. The neck of the sac was the size of a small lead pencil. The sac was then dissected from the cord, after dividing the former transversely above the testis, and the part of the sac projecting below the testis was amputated. The openings into that part of the sac enveloping the testis were sewn together, thus forming a new tunica vaginalis. The sac was then amputated at the internal ring after transfixion and ligation. A space was bored by the finger in the small left side of the scrotum, and the testis was placed in the bottom of the scrotum, where it was retained in place by a suture. The testis showed a tendency to slip upwards, so it was retained in place by two plain catgut purse-string sutures passed about the cord just below the external ring. The operation was completed by performing the Bassini operation for the hernia.

HYSTERECTOMY FOR SLOUGHING FIBROID; SPINAL ANÆSTHESIA; BLOOD TRANSFUSION.

Dr. McWilliams presented a woman of forty-six years of age who was admitted to the Presbyterian Hospital, in the service of Dr. Blake, on May 5, 1909. A week prior to her admission she had had a sudden profuse uterine hemorrhage caused by an enormous fibrous tumor of the uterus, which reached half way above the navel. On admission, her hæmoglobin was 25 per cent. She was kept in bed and an operation for the removal of the uterus was delayed in the hope that the hæmoglobin would increase. Four days later, however, there was a sudden rise in temperature to 103° F., coincident with the appearance of a very foul vaginal discharge and the expulsion of necrotic pieces of fibrous tumor from the vagina. On the sixth day after admission, her hæmoglobin was 20 per cent.

In considering the best way of conducting the hysterectomy, which seemed urgently necessary, a preliminary blood transfusion was thought of, but abandoned because it was deemed likely that hæmolysis would take place, in view of the septic condition of the patient's blood. Since her hæmoglobin was so low (20 per cent.), it seemed advisable to avoid the administration of ether. Spinal anæsthesia was used, 1 c.c. of a 5 per cent. solution of tropacocaine, injected through the space between the second and third lumbar vertebræ. An hour and a half before the operation, $^1/_{250}$ grain of scopolamine, and $^1/_8$ grain of morphine

FIG. 1.

Perineal ectopia testis.

were injected hypodermatically, and the same doses were again administered three-quarters of an hour before the operation. Anæsthesia was perfect throughout the operation, which lasted 45 minutes. The uterus was removed completely, together with the left tube and ovary. The patient was in good condition after the operation, with a pulse of 94. There was vomiting but once, four hours after the operation. There were no after-effects referable to the spinal anæsthesia.

The patient failed to improve after the operation. On the third day there was 15 per cent. of hæmoglobin, with 1,560,000 red cells. On the seventh day the hæmoglobin was 12 per cent., with 1,400,000 red cells, and on the ninth day the hæmoglobin had fallen to 10 per cent., with 1,260,000 red cells. The patient was not digesting her food. She was apathetic and somnolent, and there was a massive œdema of the left abdomen and entire left lower extremity, extending up to the costal margin, due to a left iliac thrombosis. At this time it was determined to resort to blood transfusion. A donor was secured, but as the preliminary tests showed that his blood caused hæmolysis with that of the patient, a second donor was obtained, whose blood caused no such hæmolysis. The coupling of the radial artery and the median basilic vein was made without difficulty with the Crile cannula, and vigorous pulsations in the vein indicated that the blood was running freely. Ten minutes after the flow was started the donor complained of headache, and eight minutes later he was restless, perspiring and somewhat dyspnœic. His blood pressure, in the meantime, had dropped from 145 to 85, and his pulse had increased from 68 to 90. The recipient's hæmoglobin, at the conclusion of the transfusion, rose from 10 per cent. to 55 per cent., and blood counts, on subsequent days, showed that the improvement in the condition of the blood was maintained. On the first day after the transfusion the hæmoglobin was 60 per cent., and the red cells numbered 4,016,000; on the third day the hæmoglobin was 62 per cent. and the red cells 3,350,000; on the fifth day the hæmoglobin was 65 per cent. and the red cells 3,930,000; on the eighth day the hæmoglobin was 63 per cent. and the red cells 3,888,000; on the twelfth day the hæmoglobin was 70 per cent. and the red cells 4,750,000, and on the eighteenth day the hæmoglobin was 70 per cent. and the red cells numbered 4,900,000.

The patient made a perfect convalescence, and now, eight months after the operation, she was in excellent health, although the left lower extremity was still somewhat swollen.

One object in presenting this patient, Dr. McWilliams said, was to bring up the subject of the value of spinal anæsthesia. In his own mind he was convinced of its great value in certain cases, of which the above was an example. In another case, seen a few days ago, the patient had a septic gangrene of the foot, of diabetic origin. The urine contained large amounts of acetone and diacetic acid, and 3 per cent. of sugar. In this case he used the injection of stovaine and strychnine solution, as advocated by Prof. Jonnesco, into the space between the last dorsal and first lumbar vertebra. Dr. Blake performed an amputation through the upper part of the thigh without the slightest pain on the patient's part, no scopolamine or morphine having been used beforehand. One of the great advantages of spinal anæsthesia is that there is little shock unless blood be lost, because the nerves are blocked by the solution.

Dr. McWilliams said he believed the method could very advantageously be used in operations for the removal of the prostate in the aged, for Talma's operation, extra-uterine pregnancies with great loss of blood, perforations of the gastro-intestinal tract, etc. According to Jonnesco, extremes of age, chronic cardiac, pulmonary, renal or hepatic diseases are no contra-indications to the use of this method.

The high dorsal injections of Jonnesco, Dr. McWilliams said, he would not try under any conditions. In the diabetic case referred to above, 1 c.c. of a solution containing 1 mg. of neutral strychnine sulphate was injected. In this solution was first dissolved 4 cg. of stovaine. As little as possible of the cerebro-spinal fluid was allowed to escape before attaching the syringe to the needle, and none was drawn into the syringe before injecting the solution. The anæsthesia was complete in eight minutes.

Dr. A. V. Moschcowitz said that a few days ago, at the Mt. Sinai Hospital, in Dr. Gerster's service, spinal anæsthesia was employed in a case of nephrotomy for calculus, and the method was perfectly satisfactory, although anæsthesia was not quite complete when the operation was begun, and about sixty drops of chloroform were given for the primary cutaneous inci-

sion. As the operation progressed, however, the anæsthesia was absolutely complete and very satisfactory.

In this case, the speaker said, spinal anæsthesia was indicated on account of the condition of both kidneys. The injection was made between the third and fourth lumbar vertebræ, and the patient was placed in the partial Trendelenburg's position.

Dr. George Woolsey, who had seen the patient shown by Dr. McWilliams both before and directly after the operation, stated that the transfusion had certainly produced an astonishingly good effect on her condition. The anæmia prior to the transfusion was extremely marked. The spinal injection in this case was made between the second and third lumbar vertebræ, and the speaker said he did not see why in the recent case mentioned the anæsthesia would not have been equally effective if the injection had been made lower down than the site advocated by Jonnesco. These low injections, below the level of the cord, were certainly much safer than the high ones, and for amputations and operations in the lower abdomen they were perfectly satisfactory. Several years ago, Dr. Woolsey said, he resorted to stovaine spinal-anæsthesia for an amputation in a woman over eighty years of age, and also in a younger patient whose general condition was such that a general anæsthetic was contra-indicated. He had found by experience that local anæsthesia also may be advantageously employed in operating for strangulated hernia, even where a resection of the bowel is necessary, and in cases like the one shown by Dr. Pool.

Dr. McWilliams, referring to the site of the spinal injection, said the space between the last dorsal and first lumbar was very wide and the puncture was easily made there. The speaker said Jonnesco had proven that the combination of stovaine and strychnine was not dangerous. The main objection to spinal anæsthesia was the fact that it might produce a paralysis of the bladder or lower extremities, but the method was certainly of value in properly selected cases. It would probably never take the place of ether. If the first dose of stovaine was not effective, there was no reason why it should not be repeated.

Dr. Frederic Kammerer said that about ten years ago, when cocaine injections were used in spinal anæsthesia he operated on about 50 cases by that method, and he had found no great difficulty in entering the spinal canal between the lower lumbar

vertebræ. The injections always gave him complete anæsthesia for operations low down, as, for instance, inguinal hernia, but when the injections were made at this point for operations in the epigastrium the anæsthesia was generally unsatisfactory.

Dr. Moschcowitz said the high injections were feared on account of their possible paralytic effect on the respiratory centres,—and after an injection between the upper dorsal and lower cervical, such as Jonnesco had made, the speaker said he did not see why we had not a right to fear a fatal result from paralysis of the accessory muscles of respiration. We knew that the lower injections produced complete motor paralysis of the lower extremities, and he did not see why the higher injections might not cause paralysis of the diaphragm. On this account he would not use the upper spinal anæsthesia, but believes that the lumbar anæsthesia has a field in surgery which will increase in the course of time.

Dr. John F. Erdmann said that in one of the cases where Jonnesco had made his injection between the last cervical and first dorsal the patient was in such a serious condition for a time that artificial respiration was necessary. In an operation for inguinal hernia under this method of spinal anæsthesia in which Jonnesco made the injection, the patient was never thoroughly anæsthetized.

Some twelve years ago, Dr. Erdmann said, when cocaine injections of the spine were used very freely, he operated on one case where he excised 12 inches of gut under that method of anæsthesia. The speaker said he had recently witnessed four operations under local spinal anæsthesia in which Jonnesco himself made the injections, and he had not been favorably impressed with the method.

Dr. Pool said that spinal anæsthesia was still on trial, and that in abdominal operations of a routine type, where very little exploration was necessary, where there were presumably no adhesions and where the parts were sufficiently accessible and mobile to enable manipulation without traction on parietal peritoneum, it was better to resort to local anæsthesia, which was quite satisfactory.

Dr. Frank S. Matthews said that in spinal anæsthesia as in local anæsthesia though pain might be entirely absent, consciousness may be a distinct disadvantage. The mental and physical

strain, due to our inability to allay the patient's apprehension, make the resulting exhaustion from operation greater than under general anæsthesia.

Dr. Matthews said that formerly in using the strong solutions of cocaine his anæsthesia was often incomplete owing to his fear of toxic symptoms. Much better results have been obtained since injecting liberal quantities of novocaine or beta-eucaine of a fraction of 1 per cent. strength. Even with weaker solutions there may be danger if the material is injected directly into a vein. This may be avoided by using a needle with blunt closed end and an opening in the side near the tip.

Dr. Woolsey said that in the cases that he had seen operated on under the stovaine-strychnine spinal anæsthesia administered by Dr. Jonnesco at the Mt. Sinai Hospital recently, the patients showed very little inclination to sleep on the table. On the contrary, they were in a very nervous state.

When the parietal peritoneum is inflamed laparotomy under local anæsthesia is more painful and less satisfactory; hence in operating for typhoid perforation, Dr. Woolsey said it had been his experience that in those cases a local anæsthetic produced more shock than a general one. These patients took ether well and came out of it with little or no shock, whereas a local anæsthetic gave rise to a good deal of shock. This was largely due to the necessary traction on the parietal peritoneum. In conclusion, the speaker said he was not very favorably impressed by Prof. Jonnesco's demonstrations.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, February 7, 1910.

The President, Dr. Robert G. LeConte, in the Chair.

GUNSHOT WOUND OF KNEE JOINT.

Dr. Astley P. C. Ashhurst related the history of a girl, aged 16 years, who while sitting on her front porch one afternoon felt a sudden pain in her right knee and found she had been shot; no explosion was noticed. She walked at once to the Episcopal Hospital, a few squares distant, and was admitted to the service of Dr. Frazier (October 17, 1908), to whom Dr. Ashhurst is indebted for the privilege of operating.

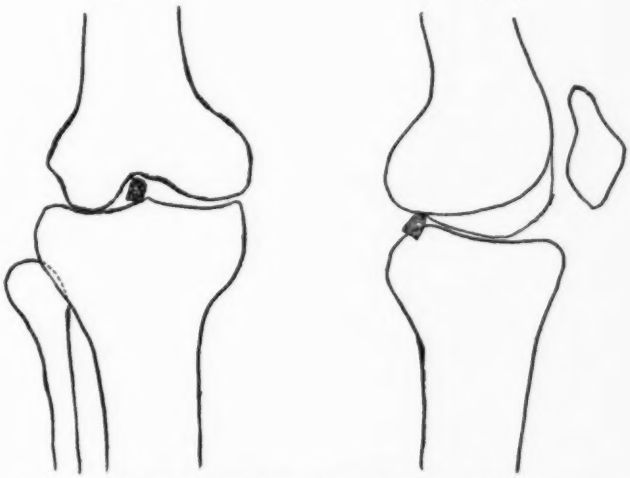
Examination showed a wound of entrance just above the head of the right fibula; the track of the bullet appeared to have been more or less transverse, but there was no wound of exit. The joint was distended with blood, slightly flexed, and very painful. Two skiagraphs were made by Dr. Welker (Figs. 1 and 2): the anteroposterior view located the bullet just to the outer side of the spinous process separating the two articular surfaces of the tibia, within the joint; while the lateral view showed the bullet just at the posterior border of the articular surface. There was no evidence of injury to the popliteal vessels, though the bullet was lodged within approximately a half inch of the artery.

Operation (seven hours after the injury): An incision of four inches was made longitudinally on the outer side of the joint, passing through the wound of entrance. The joint was opened and a quantity of fluid blood evacuated. There was a little splintering of the head of the tibia and external semilunar cartilage. The posterior capsule was cautiously dissected off the joint nearly to the midline, when the bullet (calibre .22) was felt

by the finger and easily extracted with bullet forceps. The bullet was flattened on one side, as if it had struck somewhere else first and ricocheted.

The joint was freely irrigated with hot corrosive sublimate solution (1:2000), removing more blood and clots, and was drained with a rubber tube. The external lateral ligament was carefully repaired with chromic catgut, and the wound was closed with additional drainage (iodoform gauze) to the site of the bullet. The knee was dressed on a posterior splint.

FIG. 1. FIG. 2.



Anteroposterior and lateral views of gunshot wound of right knee joint.
Fig 1, Anteroposterior view. Fig. 2, Lateral view.

The tube was removed on the third day; weight extension was applied October 24, as the knee showed a persistent tendency to flex. The wound was entirely healed in six weeks, without any signs of arthritis having developed; and the patient was discharged December 19, 1908, wearing a plaster cast. She was referred to Dr. Davis' service at the Orthopædic Hospital, and was fitted with a brace, arranged to allow gradually increasing motion at the knee joint. She wore this until the end of May, 1909, at which time she had full extension of the knee, and flexion to a right angle. She walks now without any limp, has flexion to 65°, and knee seems as good as ever. (See Figs. 3 and 4.)

GUNSHOT WOUND OF THE SKULL, WITH RUPTURE OF THE LONGITUDINAL SINUS.

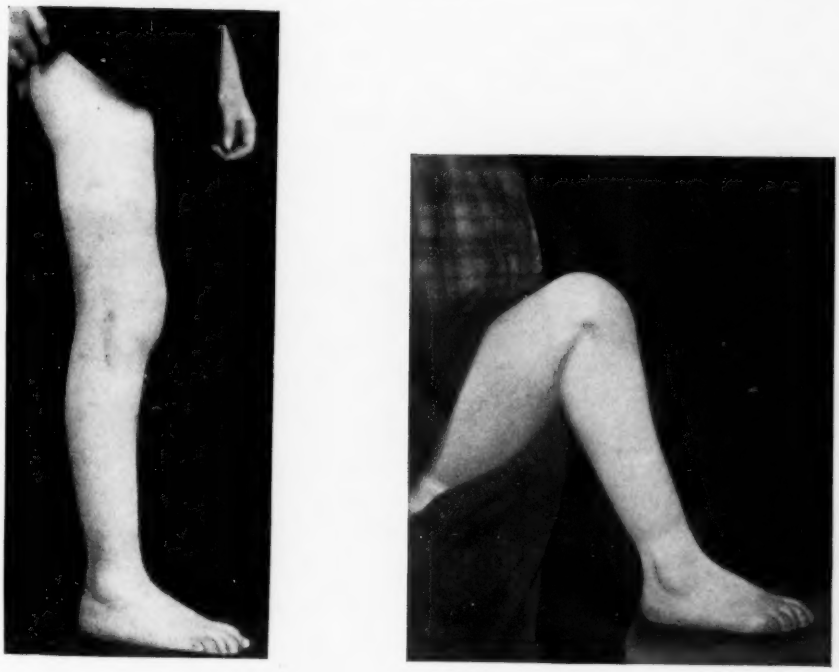
Dr. Ashhurst also related the history of a man, aged 32 years, who shot himself in the centre of the forehead with a bullet of .38 calibre, aiming directly backward. He was at once taken to the Episcopal Hospital, where he was admitted to the service of Dr. G. G. Davis (February 13, 1909), to whom Dr. Ashhurst is indebted for the privilege of operating.

When admitted there was moderate bleeding from a stellate wound of the soft parts directly in the centre of the forehead, below the hair border. Powder burns were conspicuous. Immediate operation was deemed advisable, as the wound was so dirty that it could only be cleaned by a formal operation. The patient was etherized, and all burned soft parts were cut away, and the wound thoroughly cleansed. One angle of the stellate opening was enlarged backward, exposing a jagged hole in the skull, about one inch in diameter; two fragments of the bullet (very much deformed) and many small pieces of charred bone were picked out of the hole. The inner table was much comminuted, driven in against the dura, and impacted; it was impossible to dislodge these fragments until the opening in the skull had been enlarged by a rongeur. A trephine was not used. On extracting the forward piece of the inner table there was a jet of blood from the superior longitudinal sinus, which was checked by packing. As each other fragment of bone was removed from the position where it was caught in the wall of the longitudinal sinus, profuse hemorrhage occurred; this was readily controlled by packing, but this packing had to be removed several times to search for and remove other fragments of bone. The dura overlying the hemispheres of the cerebrum was not ruptured, and the brain was not exposed; but the longitudinal sinus was extensively torn, and only the impaction of the skull fragments in the walls of the sinus prevented the man from bleeding to death before admission to the hospital.

For permanent control of the hemorrhage from the longitudinal sinus two strips of gauze were used, each two inches wide and 24 inches long.

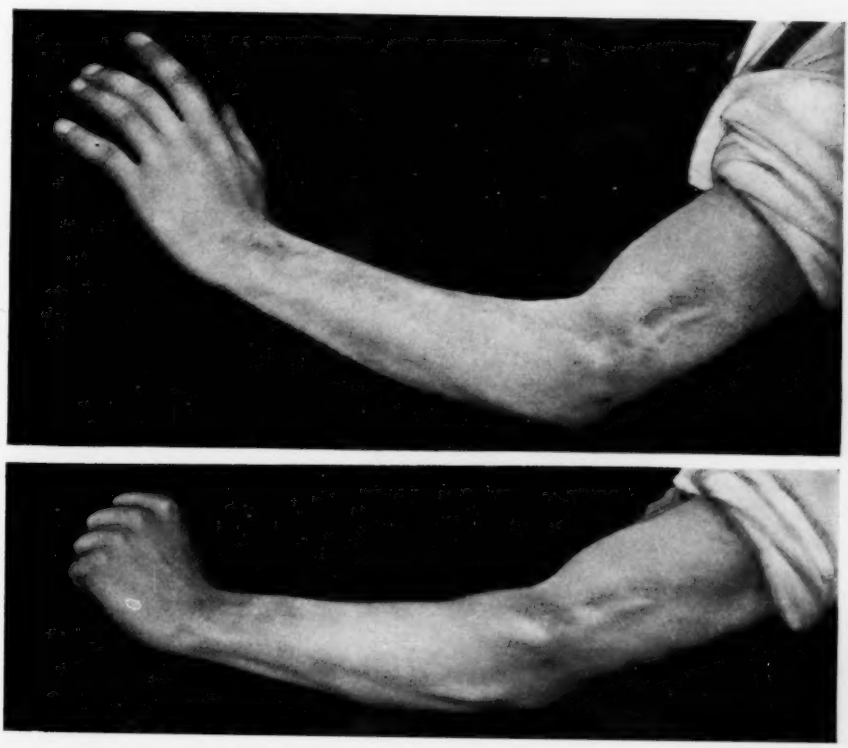
The patient did well after the operation. The packs were removed without accident three days later; and his subsequent

FIGS. 3 and 4.



Result of arthrotomy for gunshot wound of the knee joint.

FIGS. 5 and 6.



Result of primary neurorrhaphy for stab wound of the musculospiral nerve (16 months after operation).

convalescence was uneventful. He was kept in the hospital a little over three weeks; has had no symptoms referable to his head since his discharge, and is now in excellent health.

AMPUTATION OF LEG UNDER ANÆSTHESIA PRODUCED BY INFILTRATION OF THE SCIATIC NERVE WITH EUCAINE.

DR. ASHHURST related the history of a man, aged 33 years, who tried to jump on to a rapidly moving freight train. His feet slipped, but he had a firm grip with his hands, and held on. His body swung in and out between two cars, his efforts to regain his footing were ineffectual, and, fearing instant death if he let go, he was dragged along for *one mile* before his cries caught the attention of the train hands; the train was then stopped, and the patient was hurried to the Episcopal Hospital, where he was admitted (October 4, 1909) to the service of Dr. Frazier, to whom Dr. Ashhurst is indebted for the privilege of operating.

The patient was almost pulseless; he had profuse hæmaturia: there was a large hæmatoma in the left loin; the left ilium was fractured through the ala; the left foot was crushed and frightfully mangled; and there was a fracture of the shaft of the left radius. Although the patient was not expected to survive, he gradually reacted under vigorous treatment, but developed pneumonia, first in the left lung, and then in the right. The hæmaturia gradually diminished. The left foot became gangrenous, but on account of the pneumonia and the other injuries amputation was postponed as long as possible. Finally, on the fifth day after the accident, in spite of the patient's bad general condition (double pneumonia, with restlessness and delirium), it was deemed imperative to remove the leg, as the stench was insufferable, and it was feared the gangrene might cause additional sepsis.

On October 9 the patient was given a hypodermic injection of morphine and atropine, and the sciatic nerve was exposed in the buttock by infiltrating the skin over it with eucaine; this was somewhat difficult as the patient began to suffocate as soon as an effort was made to turn him on his side. But by bringing his buttock partly over the edge of the table the nerve was exposed, and injected with 15 to 20 minims of 2 per cent. eucaine solution. This wound was then closed. Next the line of the proposed skin incision for the internal flap (supplied by the internal saphenous

nerve) was anæsthetized by the local use of eucaine, and the leg was amputated (Sédillot's lateral-flap method, modified) without the patient suffering more than from the tactile sensation of the instruments. All pain sense was abolished.

The patient's convalescence was tedious, but uncomplicated. The various injuries have healed, leaving no apparent disability, and he has an excellent stump.

PRIMARY NEURORRHAPHY OF MUSCULOSPIRAL NERVE FOR STAB WOUND: PERFECT FUNCTIONAL RECOVERY.

DR. ASHHURST related the history of a man, aged 17 years, who was stabbed in the left arm, probably with a penknife, about midnight of October 7, 1908. He was taken at once to the Episcopal Hospital, and admitted to the service of Dr. Frazier, to whom Dr. Ashhurst is indebted for the privilege of operating. On admission the boy had a band tied tightly around the upper arm, to control profuse hemorrhage from a punctured wound above the external condyle of the left humerus. The stab wound was enlarged by the Resident, and several spurting vessels were ligated. The next day, on examination, it was noticed that there was wrist-drop; there was complete paralysis of both the posterior interosseous (inability to extend fingers or wrist) and the radial nerves (anæsthesia over extensor surfaces of thumb and index fingers, and over the anatomical "snuff-box").

Operation was done sixteen hours after the injury. It was found that the stab had passed through the fibres of the brachialis anticus muscle almost to the bone; the proximal end of the musculospiral, cut cleanly across, was found in the wound; the distal end had retracted, but was easily found by separating the brachialis anticus and brachioradialis muscles. The distal end was then pushed under the uncut fibres of the brachialis anticus, and sutured to the proximal end by two mattress and one simple suture of fine silk, threaded in an ophthalmic needle. The two mattress sutures were passed directly through the trunk of the nerve; while the simple suture passed through the sheath only. After the suture was completed the place of union could no longer be detected with the naked eye; there was apparently perfect apposition. The wound in the brachialis anticus and the deep fascia were separately sutured with chromic catgut, and the skin was closed with silkworm gut, a small gauze wick being left for drain-

age. The arm was dressed on an internal angular splint. The wound healed without suppuration.

There was gradual improvement in the wrist-drop after about three months, although the patient was treated with massage and electricity for only a very short time. At the end of a year recovery was complete. There is now only the slightest evidence of impairment of power in the muscles supplied by the posterior interosseous, and no anæsthesia exists; the fingers and wrist can be fully extended, but not so vigorously as before (see Figs. 5 and 6).

THE DIAGNOSIS OF TYPHOID PERFORATION.

Dr. A. D. Whiting read a paper with the above title, for which see page 697.

Dr. John H. Jopson said that Dr. Gittings and he had made a statistical study of perforation in children in a paper published recently. In this study there were analyzed 45 cases published since Elsberg's paper, which appeared in 1902. They did not find any very marked difference in the symptoms in childhood than in adult life; they did find pain, tenderness, rigidity, distention, leucocytosis, vomiting collapse,—all valuable and all present in a considerable number of cases; a certain number of these symptoms were present in a large majority of cases. Another interesting fact was that the mortality was much lower in patients below puberty than in the adult class.

Dr. Charles F. Mitchell thought that the difficulty from a surgical standpoint in making a diagnosis in perforation in typhoid fever is that the surgeon does not see the case before the symptoms start. Very often he is called in when the patient is suffering from general peritonitis and then diagnosis is very simple. It is important that surgeons in a general hospital where there are a large number of typhoid-fever cases should study these cases with the physician, so that the diagnosis of perforation might be arrived at earlier. Another important thing is that when called in to see a doubtful case, it is best to defer decision until one can see the patient again, in order that one may have time to consider the case carefully, rather than to be obliged the first time one sees the patient to give a final decision as to whether or not perforation is present when one knows but little of the patient's former condition.

Dr. Walter G. Elmer said that with regard to conditions simulating perforation he could recall one case of a trained nurse who in the third week of typhoid fever, and with a temperature running pretty evenly at 103°, suddenly developed all of the symptoms of perforation—a sudden drop in the temperature from 103° to subnormal, followed by pain in her right side, with increasing local tenderness and muscular rigidity. At operation he found an acutely inflamed appendix and an acute peritonitis spreading up the colon. No perforation of the intestine or appendix had taken place. The appendix was removed, the incision closed and the patient recovered. This patient presented a typical clinical picture of intestinal perforation in typhoid fever.

Dr. Robert G. Le Conte remarked that as a rule the physician does not call in a surgeon until there is grave doubt in his mind as to whether perforation has taken place. The physician expects the surgeon in a few moments to make a diagnosis in a case in which he has been doubtful for hours, or perhaps even days; and having made a diagnosis, the responsibility rests with the surgeon and not the physician. If surgeons could study these cases for a few hours, from the time when the thought of perforation has first entered the physician's mind, fewer errors of diagnosis would be made. One must not forget that perforation can take place and be temporarily closed by adhesion to a neighboring coil of intestine or to the omentum, and he believed that when one finds at operation, perforations from the size of a lead pencil to a five-cent piece, that these started as minute openings which were temporarily closed off until the whole bottom of the ulcer had necrosed. Dr. Davis showed him a very interesting specimen some years ago from a patient that had had characteristic symptoms of perforation, in whom operation was not undertaken. The patient recovered from this attack, but eight or ten days later the symptoms reappeared, ending in death. At the autopsy the first perforation was found entirely closed by a plug of omentum which protruded into the lumen of the gut, and near by a second perforation was found patulous, which had caused the patient's death.

Dr. G. G. Ross said that he had had a case presenting typical symptoms of perforation upon which he operated promptly and found a plug of omentum plastered over the opening. He presumed there was an opening at the time, but he did not disturb

the plug of omentum but stitched the edge of it and returned the bowel. Two weeks afterwards the patient had a second perforation from which he died. At post-mortem it was found that the plug of omentum had held until the bowel around the edge had sloughed and that the track of the drainage tube had become gangrenous. This was an illustration of Dr. Le Conte's point, that the patient had a perforation reinforced by nature, then a sloughing around the plug of omentum.

Dr. A. P. C. ASHHURST said that while the diagnosis of perforation in typhoid fever is difficult, it is much more difficult to diagnose the occurrence of a second perforation some days after the first has been sutured. When the patient is comparatively well in the first place and a peritonitis develops it is not difficult to detect, but when, as in a second perforation, the peritonitis simply increases, it is very difficult to make the diagnosis. If the diagnosis of these secondary perforations could be made and if the perforations were sutured, the mortality of typhoid perforation would be markedly reduced. Better than to cure perforations is to prevent their happening. Until within the last three or four years at the Episcopal Hospital they had had a tremendous number of typhoid cases, during one year about 125 in the wards constantly, and there were perforations in the usual proportion of cases. Upon the introduction of filtered water into northeast Philadelphia the number of cases in the wards dropped to an average of 10 or 12, with but 4 or 5 perforations in the last three years.

DR. A. D. WHITING (in closing) said that as to the value of leucocytosis, he would say that it is of but little value, some cases showing an increase followed by a drop, others showing no variation in the leucocyte count even when taken hourly or half-hourly. In the early cases of this series the leucocyte count was made much more frequently than at the present time. Generally one count is made, and if that is high it is supposed to indicate trouble in the abdomen other than ordinary typhoid. A leucocyte count is made in every case of typhoid and often a normal leucocytosis is found. He thought the leucocyte count of little value in determining the presence or absence of perforation.

In general, perforation gives a doubtful picture until there is a well-established peritonitis; even then one may operate and find no perforation. There is no doubt that pain, tenderness,

rigidity, and vomiting are of great value when present, but there are many cases where these are not present. There may be perforation and death where no symptoms of perforation have been noted. Of course, the typical case, with sharp, stabbing pain, the patient writhing in agony, followed by peritonitis, rigidity and tenderness, is easy to diagnose. The stand he takes is that all calamities occurring in a case of typhoid should be suspected as being due to perforation, and that perforation should be diagnosed and operation instituted when no other complication can be found to account for the calamity.

The reason so many of the cases at the German Hospital were operated upon was because of the general theory that operation is advisable if there is suspected perforation: an unnecessary operation will not do so much harm as an unoperated peritonitis from perforation. It was lucky that so large a number of cases showed perforation. It was due more to guesswork than actual skilful diagnosis. Diagnosis of spreading peritonitis is comparatively easy, but one cannot tell whether it is due to perforation, leakage, or what not.

The time of operation after diagnosis varied from 6 to 36 or 48 hours. Some cases had been treated at home for typhoid and had been brought to the hospital after perforation had been diagnosed, and operation was at once performed. There were two such cases which died and one which recovered.

The idea of having the surgeon in attendance with the physician in all cases of typhoid is good, and should be instituted if the burden of the diagnosis is to rest upon the surgeon. The stand he takes is that the physician, who knows the case and its general behavior and can readily note the presence of any symptom out of the ordinary, should be the one to make the diagnosis and not the surgeon; if the surgeon is to help in the diagnosis he should be in attendance on the case from the beginning.

In regard to cases of slow peritonitis, with slight perforation, which had been mentioned, there are several cases in this series where there was either leakage or two or more perforations taking place at different times; others show an attempt to wall off and protect the general peritoneal cavity. In one case two perforations were found, one apparently sealed by adhesion of the ileum to the cæcum. In another case the patient had a sharp pain with-

out rise or fall of temperature, without any other symptom at all, and afterward steadily improved for four or five days when there occurred an explosive peritonitis from which the patient died. Autopsy revealed a small perforation sealed off by adhesions between the site of the perforation and the abdominal wall, where an abscess had formed which finally ruptured.

The treatment of the peritonitis at the time of operation varies. Most of the cases operated upon by Dr. Deaver had the pelvis cleaned out, drainage being instituted by a glass tube in the pelvis and sometimes gauze into the pelvis and to the seat of perforation. In two of his own cases the abdomen was irrigated with saline solution, but in the majority of cases nothing was done beyond instituting drainage. The after treatment at the German Hospital is practically the Murphy treatment for peritonitis.

SARCOMA OCCURRING IN SCAR TISSUE OF THE BACK, WITH METASTASIS TO THE LUNG: PRESSURE NECROSIS OF THE AORTA, WITH HEMORRHAGE AND DEATH.

Dr. Addinell Hewson reported the history of a man, aged 72 years, who was admitted to the American Oncologic Hospital October 3, 1908, complaining of a growth in the scar of a very extensive burn over the spine and dorsal aspect of the right scapula.

He was injured in a railroad wreck 22 years ago, sustaining a very extensive burn, the scar of which extended on the dorsal groove from the seventh cervical to the second lumbar vertebræ, completely encircling the chest on the right side and including the shoulder and arm, fastening the right arm to the right side of the chest in such a way that the axilla was not more than 8 centimetres from the olecranon process of the ulna, this fixing the arm to the right side of the chest. There was pressure necrosis of the skin to the axillary side of the elbow.

After the healing of the burn his weight was only 70 pounds.

Later he was in a second railroad wreck, since which time he has had hæmiplegia of the left side and right-sided partial facial paralysis.

He had a fracture of the right tibia, the date of which could not be obtained; he sustained a right-sided, indirect, inguinal hernia by a fall at the Soldiers' and Sailors' Home which was reducible.

On examination a tumor was found (Fig. 7) which originated in the scar tissue over the supraspinous and infraspinous fossæ of the right scapula. This tumor was dark red in color, nodulated, and showed a tendency to break down. At the circumference it showed evidence of infiltration into the surrounding tissues. No indurated glands could be felt anywhere. The patient noticed that this growth appeared about twelve months before he was first seen. It increased very rapidly and when first admitted to the hospital its base was 20 cm. in diameter. The masses composing this totality varied from the size of a pea to 7.5 cm. by 15 cm. The elevation of these tumors was 2 cm. There was a tendency to bleed freely on manipulation.

Before admission to the hospital some of the smaller nodules had been tied off but no microscopic examination had been made. Necrosis began about eight months before, since which time the growth had been more rapid. Where the tumors had broken down there was no tendency to excavation but to an increased proliferation of the tumor mass.

The patient's height was 5 ft. 6 in. and weight 155 pounds. The pupils were normal and reacted promptly to light and distance. There was no œdema, no clubbing of the fingers, and no palpable enlargement of the superficial lymph-nodes.

The tongue was clean, the mucous membrane of the mouth was slightly pale. The pharynx appeared normal.

The morning temperature was 97.8 degrees; the pulse 98, regular, of full volume and tension; the respirations were 24 per minute.

An examination of the lungs showed no pathological signs.

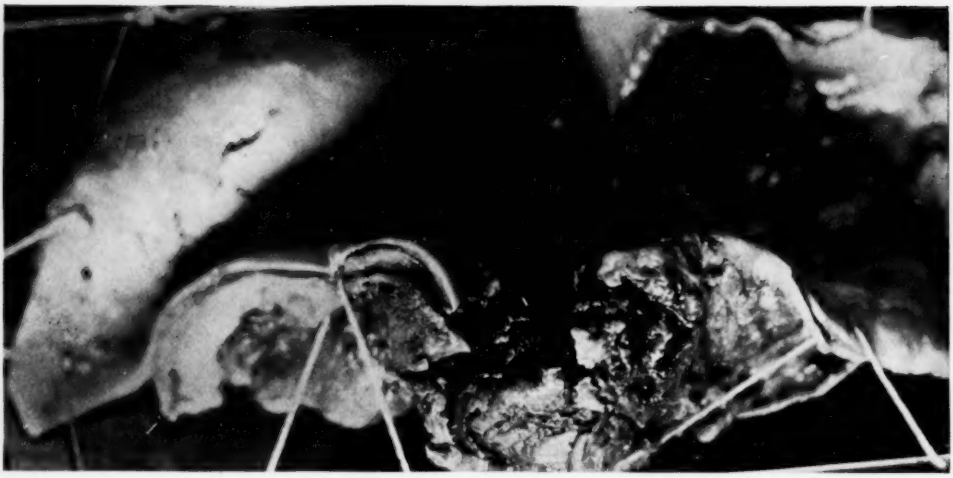
The heart apex beat was in the sixth interspace in midclavicular line, the cardiac dulness extended from the fourth rib to the sixth interspace and from left edge of sternum to the midclavicular line; no murmurs were heard. The pulmonary diastolic sound had a decided splashing quality. An examination of the abdomen showed no pathological signs except the right-sided inguinal hernia already referred to.

An examination of the blood showed: Erythrocytes, 3,700,000; leucocytes, 11,800; ratio, 1 to 313 +; hæmoglobin, 54 per cent.; color index, 0.73. Differential count: Polymorphonuclear neutrophiles, 77 per cent.; lymphocytes, 13 per cent.; large mononuclears, 3 per cent.; transitionals, 2 per cent.; eosinophiles, 5 per cent.

FIG. 7.

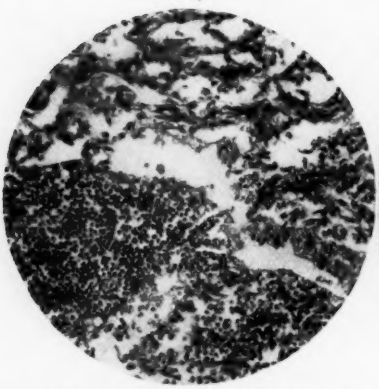
Sarcoma developing in scar tissue of the back.

FIG. 8.



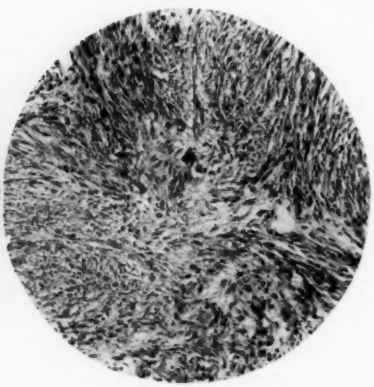
Showing erosion of wall of aorta by tumor.

FIG. 9.



Photomicrograph at the site of metastasis magnified 300 diameters taken at postmortem.

FIG. 10.



Photomicrograph of tumor of back magnified 150 diameters taken at first operation.

An examination of the urine showed: Color, dark amber; reaction, acid; specific gravity, 1016. There was a slight flocculent sediment which contained a few epithelial cells and uric acid crystals. There was no albumin, no glucose, no indican and no acetone.

After consultation with the entire Medical Board it was decided that cautery and X-ray be tried before dismissing what seemed to be a hopeless case.

Under strict asepsis and chloroform anæsthesia, a small tumor was enunciated at the most cephal part of the growth for examination and the opening closed. The caudal third of the growth was removed by a cautery knife, the remaining two-thirds were scarified with the cautery knife at red heat and one seemingly new growth was punctured in two places. The wound was dressed with dry gauze and cotton and a hypodermic injection of morphine was given. There was no elevation of temperature after this operative interference. It was noted 48 hours after the operation that proliferation of the growth had begun. The patient was out of bed three days after the operation and on the fourth day was able to walk some distance from the hospital.

On October 31 it was found that the growth had recurred over the entire area from which the tumor was removed by the cautery knife on the 12th, and that the new mass of tumor tissue was larger than that originally removed. On this date the Pacquelin cautery was again applied to the entire growth without the administration of an anæsthetic, because no pain was felt unless the uninvolved scar tissue was touched with the instrument.

A note on November 2 states that at the site from which the growth had been removed by the cautery knife, the tumor had increased to three times its original size. The electric cautery knife was then applied thoroughly to the entire mass without an anæsthetic.

Some of the cauterized material was removed on November 8 with considerable hemorrhage.

On November 15 the ward notes state that the discharge had been very profuse and offensive since the last cauterization. The patient showed a tendency to go down hill. The electric cautery was again used on November 18. On the 19th at 1.45 A.M. the nurse reported that after severe coughing there was some hemorrhage from the mouth, which lasted eight minutes. The

pulse rate was increased, regular and strong. At 4 P.M. of the same day some bright blood was found in the mucus, which was coughed up. On the 21st at 4 P.M. while sitting in the sun-parlor the patient was taken with a severe hemorrhage from the mouth, which came on without warning. The blood came out in a great gush; he became cyanosed, then strangled and died in 10 minutes.

I am indebted to Dr. C. B. Longenecker, Director of the Laboratory of Physics, for the photographs herewith submitted and to Dr. John M. Swan, Director of the Laboratory of Pathology, for reports of the pathological examination and autopsy. The examination of the specimen enucleated at the first operation resulted in a diagnosis of mixed-celled sarcoma.

The autopsy revealed the cause of death to have been hemorrhage from the aorta, due to pressure erosion of metastatic growth in posterior mediastinum between thoracic aorta and posterior margin of right lung.

In the caudal lobe of the right lung the lung tissue is replaced toward the dorsal part of the lobe by a solid mass resembling the new growth described on the surface of the body. Around this there is an area of less dense tissue, and farther removed again the lung looks normal except for the fact that it is quite moist.

There is a good-sized cavity in the part of the lung containing the neoplasm. The bronchi passing to this part of the organ are filled with clotted blood. The portion of the long tissue adherent to the mediastinal tissues presents a small opening through which a probe can be passed to the thoracic aorta immediately beneath it.

The aorta is atheromatous. On the right side of the thoracic aorta just cephalad to the aortic opening in the diaphragm there is an irregular opening with ragged edges 12 mm. in diameter, into the mass of tissue already described as adherent to the mesial surface of the right lung. The interior of this mass contains a cavity about 20 mm. deep, which is filled with semi-fluid blood. There is no attachment apparent to the underlying vertebral column. The intercostal veins where they empty into the vena azygos major are patulous and filled with blood. and no connection can be demonstrated between the cavity and the vena azygos major (Fig. 8).

The tumor is composed of spindle cells. In many places there are good-sized bundles of fibrous tissue, which are undergoing granular degeneration, and there is a good deal of œdema to be seen (Figs. 9 and 10).

Dr. G. G. Ross said that it was discouraging to think how absolutely intractable such a growth is. Still another side to the picture are the suggestions of Bloodgood and Coley, both of whom show that the results in such cases depend upon the type of sarcoma to be dealt with. The so-called fibrosarcoma of Bloodgood, a low grade of malignancy, offers some hope for local procedure; in the other malignant types it was his experience that amputation does little good. He recalled a case of fibrosarcoma in a girl 12 years of age, who had injured her wrist; she presented a deformity like a typical Colles' fracture. The X-ray showed it to be a tumor, and a local operation was done. After three years the growth had slowly recurred but was in no worse condition than when originally seen. Amputation was then done at the shoulder. That was four years ago and the girl is still perfectly well. Coley claims that there are a number of cases of more malignant type in which the use of his toxins of streptococcus and prodigiosus after amputation offer some curative results.

Dr. Robert G. Le Conte said that his experience in these cases was that nearly all of them die of internal metastatic growths. Whether one amputates or simply resects the diseased area, it is not the local return but the internal growth that kills. He had had perhaps ten or a dozen amputations in which there was local recurrence in but one case, and yet, in all these cases, the patients ultimately died of internal growth.

Dr. Swan said the subject of sarcoma, of course, will not be settled until the cause is found. So far as his experience had gone, nearly all sarcomata are mixed-celled growths, and he made a diagnosis of type according to the predominating cell found. As he understands it, sarcomata begin as small round-celled growths. These round cells belong to the same class of cells as those found in the connective tissue in the embryo, and they become large round cells; these become spindle cells and the spindle cells may become converted into a varying amount of fibrous tissue. The origin of the giant cell is not definitely settled. At the American Oncologic Hospital in the last two

years, three cases of sarcoma, including this one, have been treated; the other two were sarcomata of the thigh, occurring in the service of Dr. McClary. According to the examination of the thighs after amputation these growths undoubtedly originated in the periosteum. One patient remained in the hospital until metastasis occurred in the retroperitoneal lymph-nodes. The metastatic growth was of the round-celled type, while the original growth was a spindle-celled sarcoma with a few giant cells.

The occurrence of sarcoma in a scar is very interesting and somewhat unusual.

Dr. Duncan L. Despard called attention to two cases which Dr. Gibbon had already reported, one the case of a girl with sarcoma of the humerus in which he removed the growth and afterwards treated the girl with Coley's toxins; this was done over two years ago; and she still remains perfectly well. There was another case sent from up in the country with an abdominal growth, of which we never got a section, but her home physician was of the opinion from microscopical examination that it was a sarcoma. This growth was reduced 75 per cent. in size under the influence of the treatment with the Coley toxins. The patient went home and came back the second time in about the same condition as when first seen and was again treated by Coley's toxins and finally left the hospital without improvement of the symptoms. Both these cases were treated by the X-ray in addition to the toxins.

Dr. Robert G. Le Conte said that he had used Coley's mixed toxins in a number of cases without any apparent benefit except in one case, where a sarcoma of the upper jaw remained stationary for about six months. Dr. Stewart, his assistant at the Pennsylvania Hospital, attributed one most excellent result to this treatment. As an antithesis he related the history of a case of lymphosarcoma of the peritoneum, intestine, mesenteric glands and retroperitoneal glands which came under observation a year ago at the Pennsylvania Hospital. The man was so distended with ascites that no organ could be felt in palpating the abdomen, and the diagnosis seemed to lie between a tubercular peritonitis and diffuse carcinomatosis of the peritoneum. At operation the parietal, visceral and mesenteric peritoneum was found studded with growths varying from a pinhead to a penny in size, and at the upper portion of the jejunum an infiltrating tumor was found

the size of an orange. These tumors were pinkish in color and much richer in the small blood-vessels than carcinoma. The mesenteric and retroperitoneal glands were also enlarged. The abdomen was closed after removal of one of these growths from the parietal peritoneum for microscopic examination. The patient slowly grew weaker, with progressive emaciation, until he died seven weeks later. At the autopsy the growths which had studded the peritoneum had practically disappeared, and the tumor of the jejunum had dwindled to a thickening of the coats of the bowel, perhaps a quarter of an inch in depth. Nothing had been done of a curative nature for this patient except the opening of the abdomen and the handling of the tumors, yet the sarcomatous masses had receded to an enormous degree in seven weeks. This case is an example of a thing occasionally seen in lymphosarcoma, namely, marked diminution in the size of the tumor without its entirely disappearing and without prolonging the life of the patient.

BISMUTH PASTE INJECTIONS IN CHRONIC TUBERCULOUS SINUSES.

Dr. John B. Shober presented a paper with the above title for which see page 715.

Dr. G. G. Davis said that his first experience with regard to this method of treatment was caused by his trying Moorhoff's paste for caries of bones in which iodoform, spermaceti wax, and oil of sesame was used. He was not successful in getting primary healing, but they did so well that he used the iodoform wax injection in other tuberculous and discharging bone cases with very satisfactory results. Since the report by Dr. Beck of his bismuth process he had used both substances. The results certainly are very good. Not very long ago he had several cases of discharging abscess in the wards of the Orthopædic Hospital; they were all cases of Pott's disease or coxalgia, and when he failed in other methods of treatment he had been able to cure them by means of these injections. If, for instance, in a psoas abscess, it does not heal after aspiration and injection of the iodoform emulsion, he does not hesitate to open, drain, and treat the resulting sinuses by means of bismuth injections. Likewise it is of use in osteomyelitic conditions, and has entirely revolutionized the treatment of these bony sinuses because from being

the most intractable they are now frequently quite amenable to treatment. Of course, there are some failures.

As to the danger of poisoning, when it comes to coxalgias and ordinary bone cases usually there is not enough of the material used to render the danger of poisoning at all imminent, but when it comes to large cavities like empyemas, etc., in which the amount used has been very large, then the danger of poisoning is greater, and certainly deaths have occurred from it. If the symptoms of poisoning do develop it is recommended that a catheter be introduced into the sinus or wound, and hot olive oil injected, thereby liquefying the bismuth and removing it from the cavity immediately, thus preventing any further increase in the poisonous symptoms by further absorption.

Dr. John B. Shober, in closing, said, although the technic of this method is very simple, it will fail if not properly carried out. The paste should be as warm as can be borne, so that it will run easily, and sufficient force should be used to drive it throughout the entire network of the tract. Unless this is accomplished there will remain foci of disease, unreached by the paste, which will continue to cause trouble. The surgeon should himself make these injections and not leave it to the inexperienced hospital interne and never to the trained nurse.

HEAD TOURNIQUET FOR THE CONTROL OF HEMORRHAGE FROM THE SCALP DURING OPERATION ON THE BRAIN.

Dr. A. C. Wood presented this apparatus and read a description of it, for which see page 646.

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